

The Forces that Destroy Historic Structures

The SC Historic Preservation Conference

Thursday, March 31, 2011
Columbia, SC

Craig M. Bennett, Jr., PE



**Let's step through time and
look at some buildings**

c. 1690-1710

- Bermuda stone buildings on Church Street, Charleston



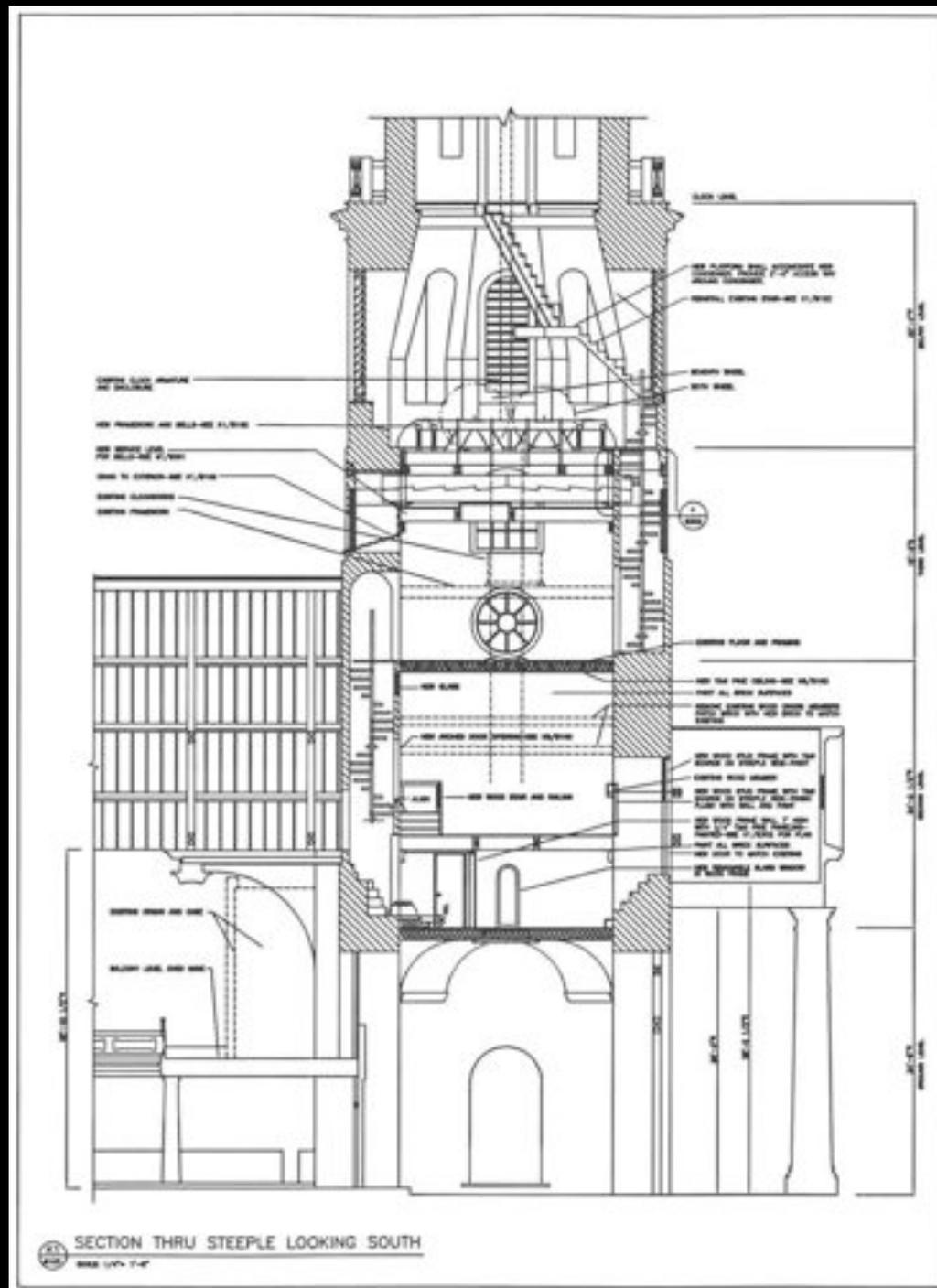
1751

- Heavy brick masonry:
 - St. Michael's,
Charleston



1751

- St. Michael's,
Charleston



1768

- Light timber framing:
 - Walnut Grove, near Spartanburg



1791

- Light timber framing again:
 - Lt. Governor Ladson House, Charleston



1791

- Lt. Governor Ladson House, Charleston



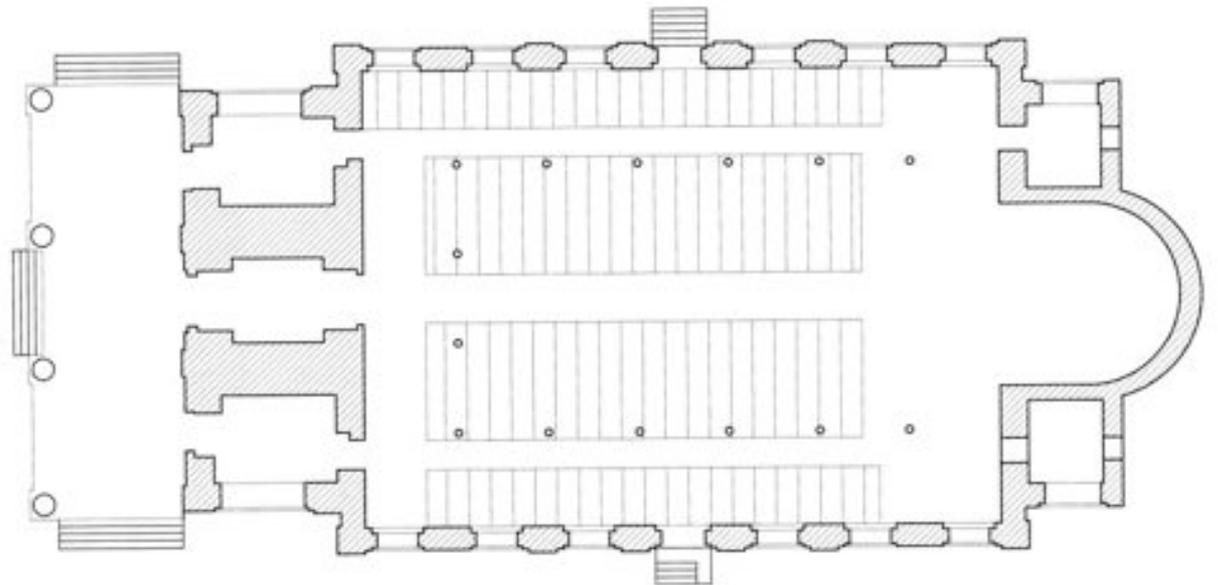
1811 to 1816

- Very heavy brick masonry:
 - The Cathedral Church of St. Luke and St. Paul, Charleston



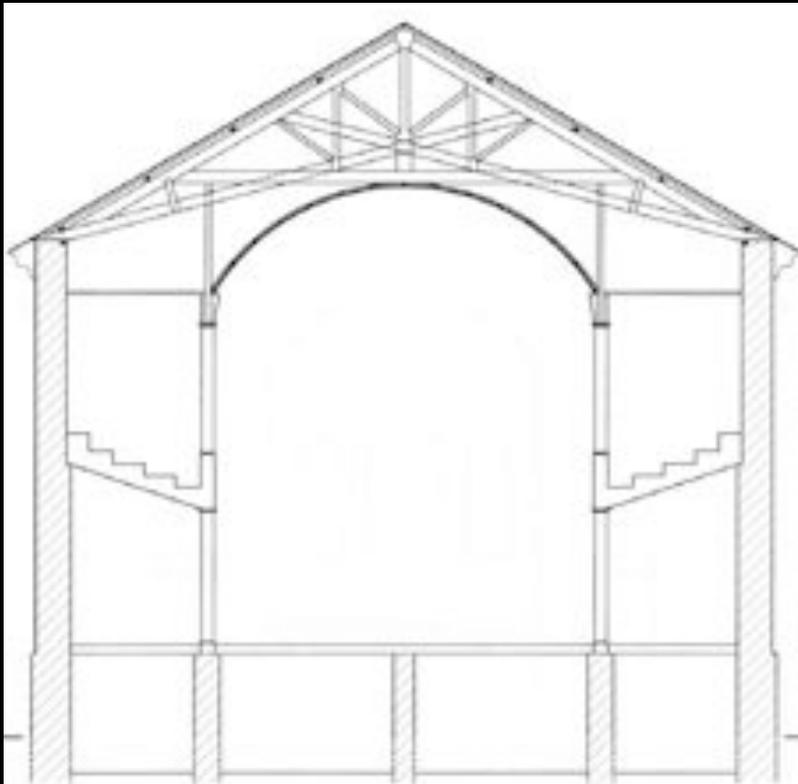
**1811 to
1816**

- The
Cathedral
Church of
St. Luke
and St.
Paul



1811 to 1816

- Cathedral Church of St. Luke and St. Paul



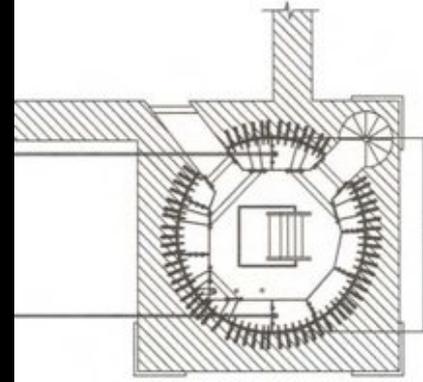
1814

- Same period,
same construction:
 - First (Scots)
Presbyterian
Church, Charleston



1814

- Heavy brick masonry and timber:
 - First (Scots) Presbyterian Church, Charleston



1820

- Only slightly lighter brick masonry construction:
 - The William Mason Smith House, Charleston



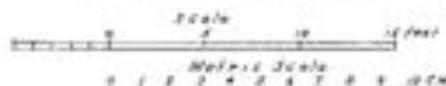
1826

- The Fireproof Building, Charleston





SECTION



Stephen Thomas - Del

U.S. DEPARTMENT OF THE INTERIOR
 OFFICE OF NATIONAL PARKS, BUILDINGS AND MONUMENTS
 BRANCH OF PLANS AND SPECIFICATIONS

NAME OF STRUCTURE
 COUNTY RECORDS BUILDING
 Charleston Charleston County South Carolina

PROJECT NO.
 13-2
 JOB NO.
 10-116

HISTORIC AMERICAN
 BUILDINGS SURVEY
 MAP 4 OF 7 SHEETS

DATE
 1934

1826

- Fireproof Building, Charleston



1820

- Heavy fortifications:
 - Fort Washington, Maryland



1820



- Fort Washington, Maryland



1846

- Fort Jefferson, Dry Tortugas



1846

- Fort Jefferson, Dry Tortugas



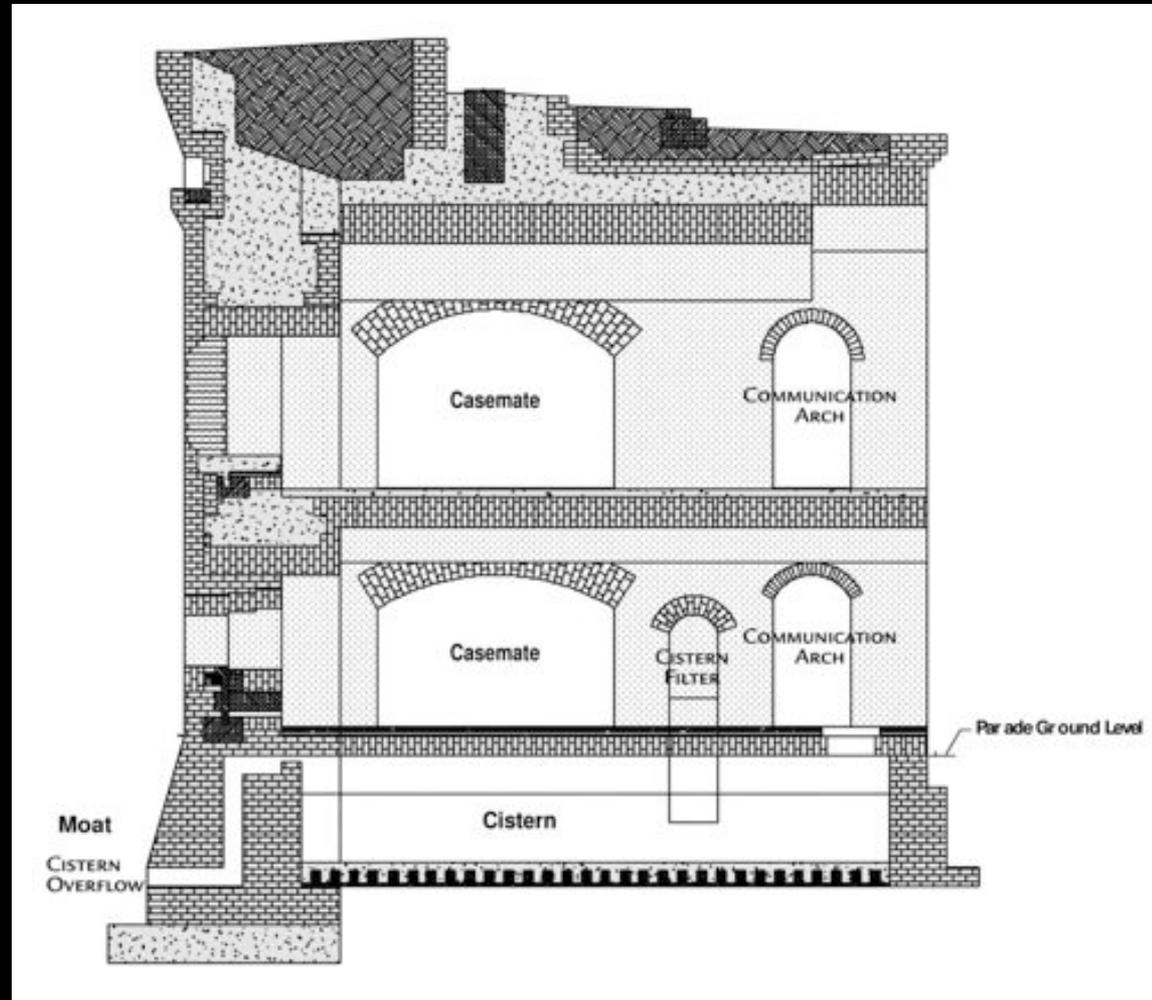
1846

- Fort Jefferson, Dry Tortugas



1846

- Fort Jefferson, Dry Tortugas



1846

- Fort Sumter, Charleston Harbor



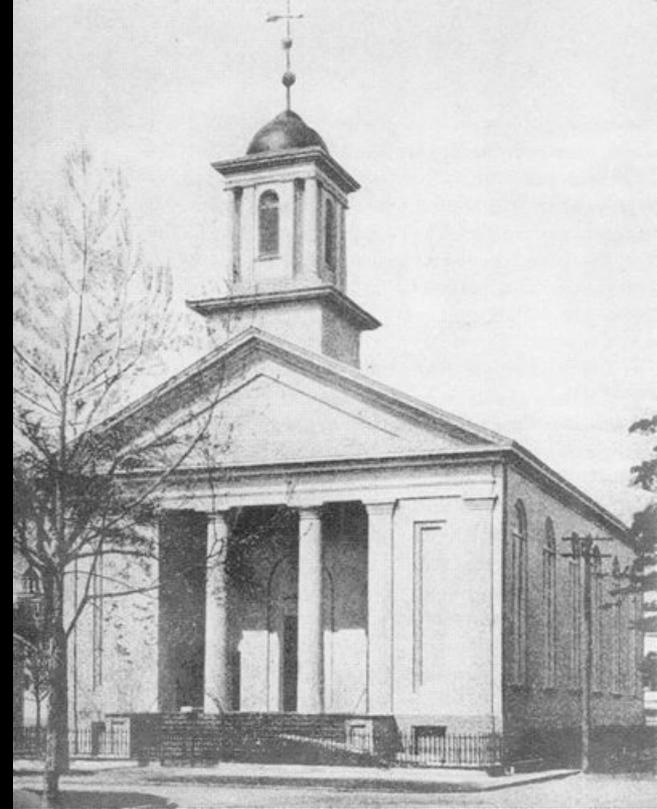
1846

- Fort Sumter,
Charleston
Harbor



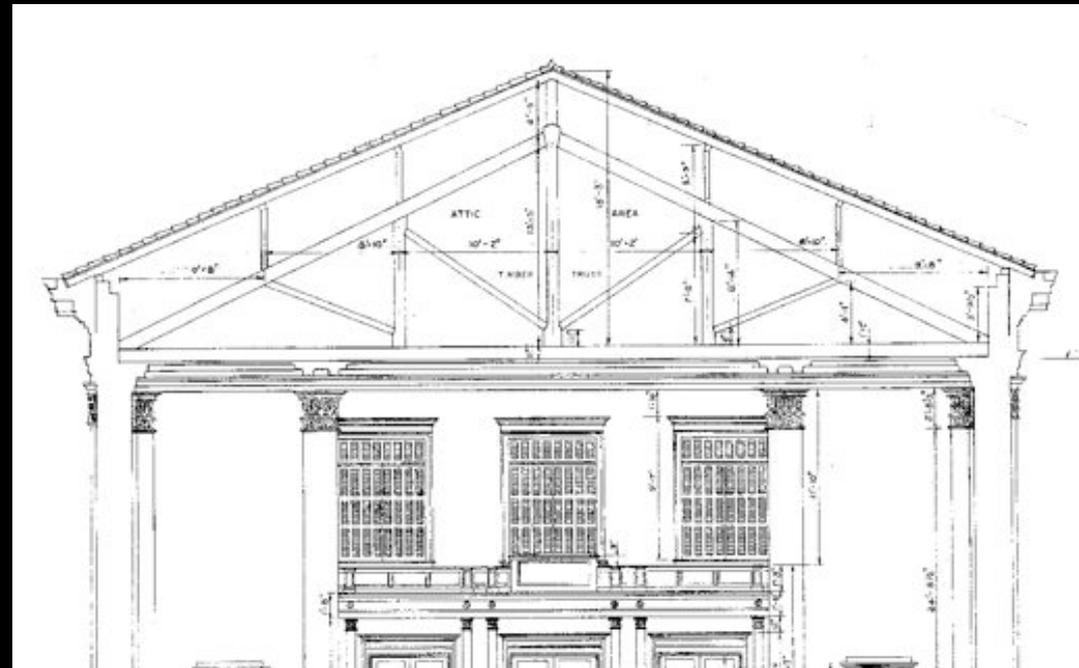
1833 and 1922

- A tale of two structures:
 - First Baptist Church, Savannah



1833 and 1922

- A tale of two structures:
 - First Baptist Church, Savannah



1842-1860



- Light timber construction: a real deception!
 - Gaineswood, Demopolis, Alabama

1842-1860

- Timber built to look like masonry:
 - Gaineswood, Demopolis, Alabama



1846

- Masonry thins out... and goes all wrong!
 - Grace Church, Charleston



1846



- Masonry wall thicknesses are cut in half
– Grace Church, Charleston

1846

- And foundations are rarely adequate:
 - Grace Church, Charleston



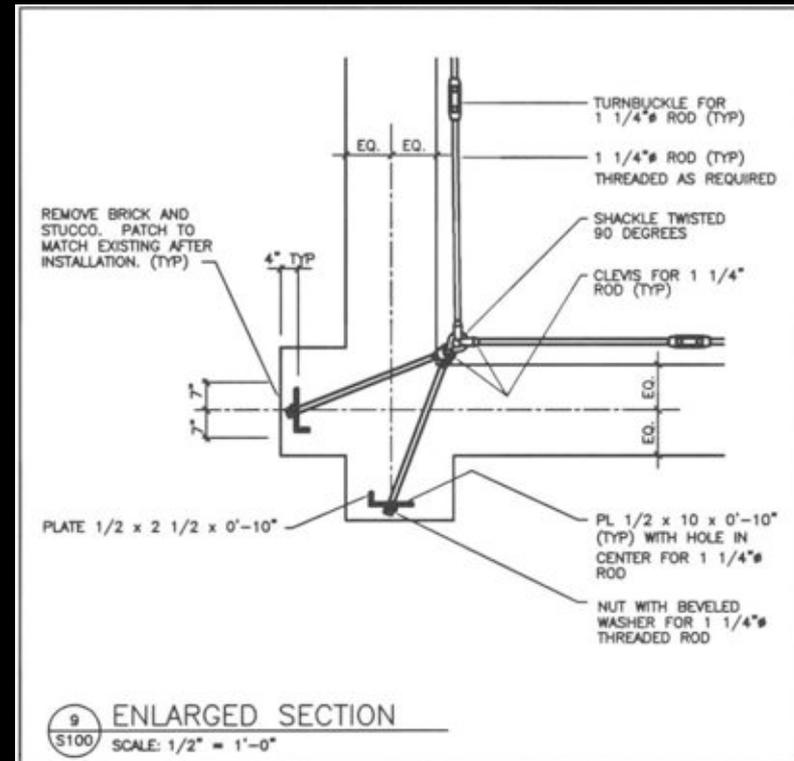
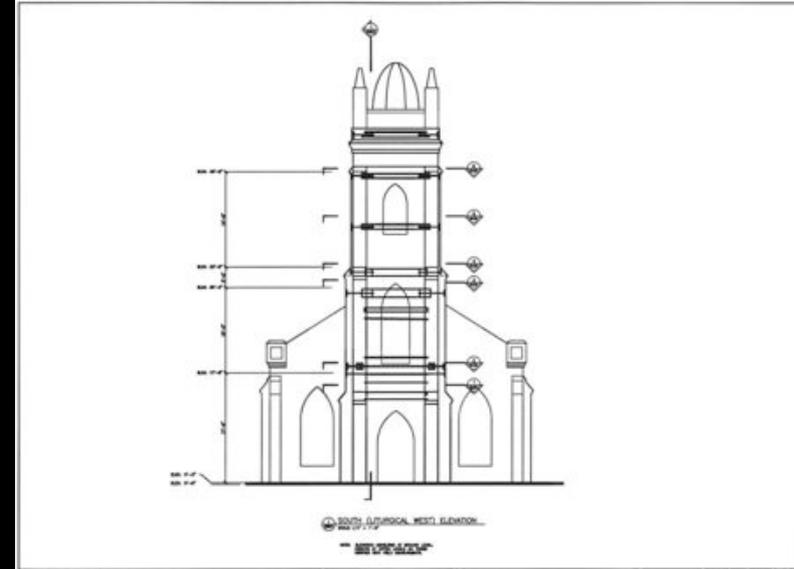
1845 and 1895

- Really thin walls:
 - 13” tower walls
 - Stella Maris,
Sullivan’s Island



1845 and 1895

- Really thin walls:
 - 13” tower walls
 - Stella Maris, Sullivan’s Island



1840s additions

- A change in construction at the William Mason Smith House



3/6/2002

1851

- Rammed earth walls:
 - Church of the Holy Cross, Stateburg



1851

- And delicate trusses:
 - Church of the Holy Cross, Stateburg



1886

- Stone masonry:
 - Breslin Tower,
Sewanee TN



1886

- Stone masonry:
 - Breslin Tower, Sewanee TN



1891

- Wrought iron frame, cast iron skin:
 - Independent Presbyterian Church, Savannah



1891

- Wrought iron frame, cast iron skin:
 - Independent Presbyterian Church, Savannah



1909-1917

- Concrete:
 - The Low Battery Seawalls, Charleston



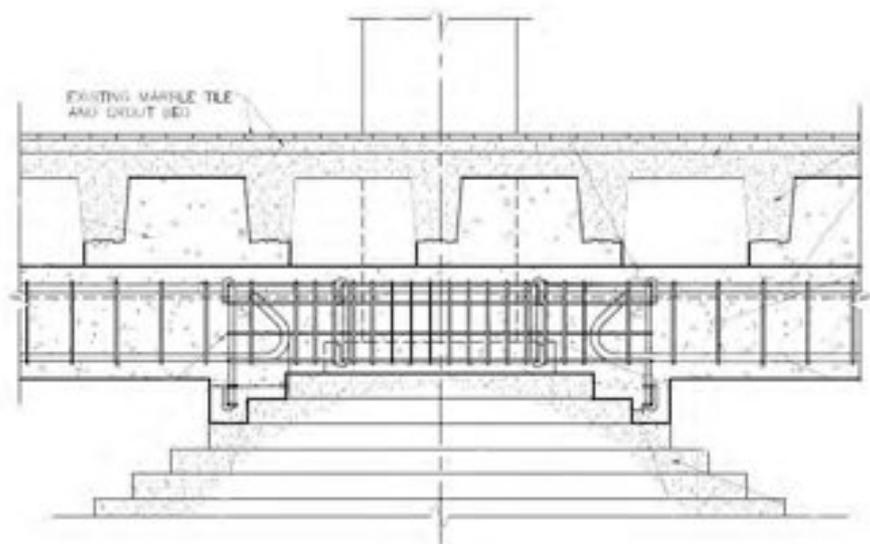
1925

- Concrete:
 - The Fort Sumter House, Charleston



1925

- Deterioration then superb repairs to concrete:
 - The Fort Sumter House, Charleston



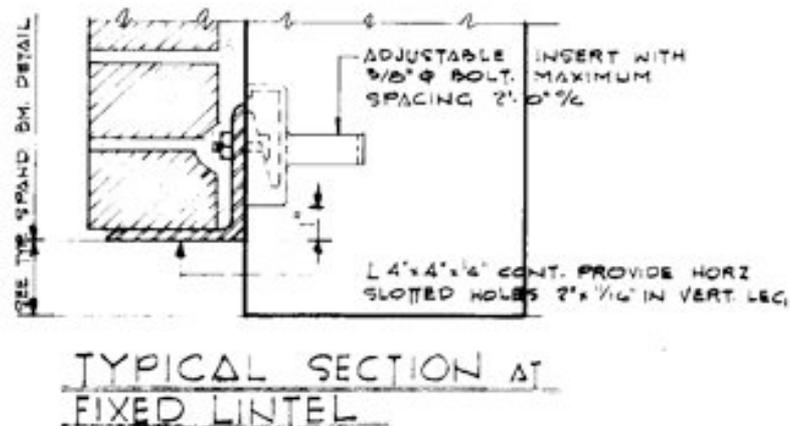
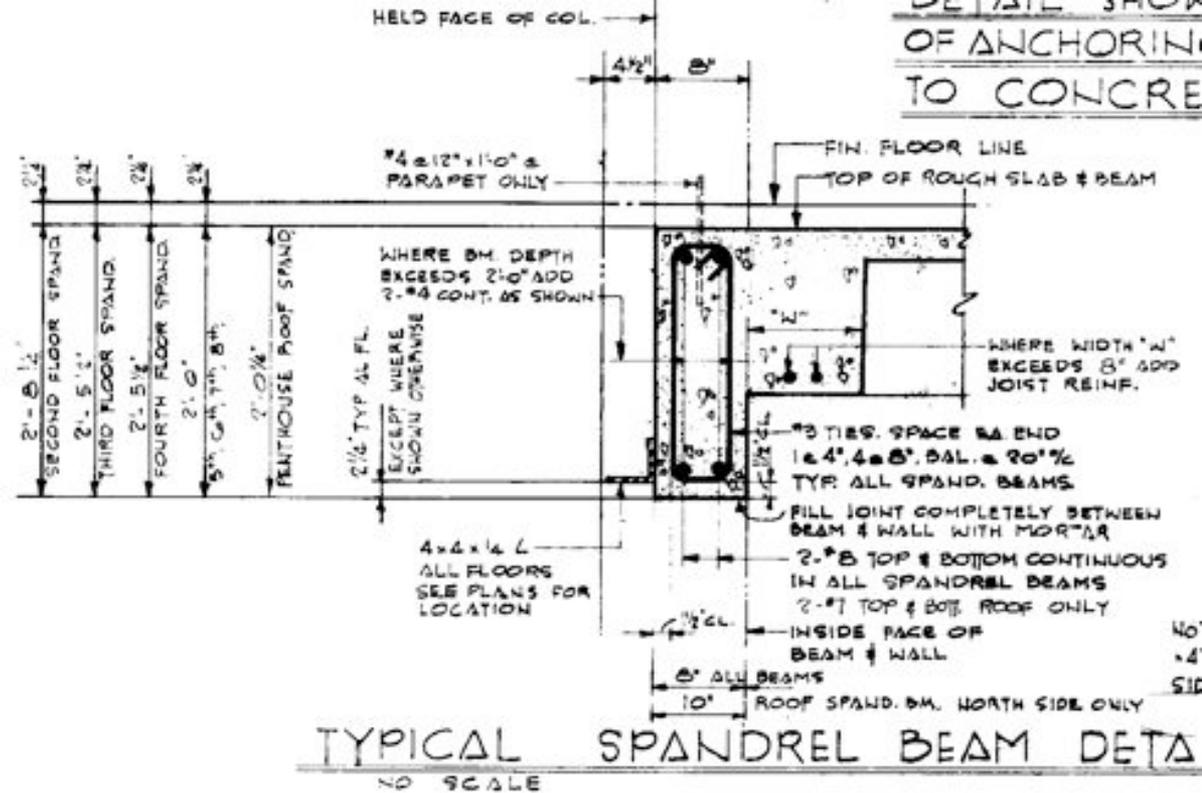
1958

- Modern framed construction:
 - The Walton Research Building



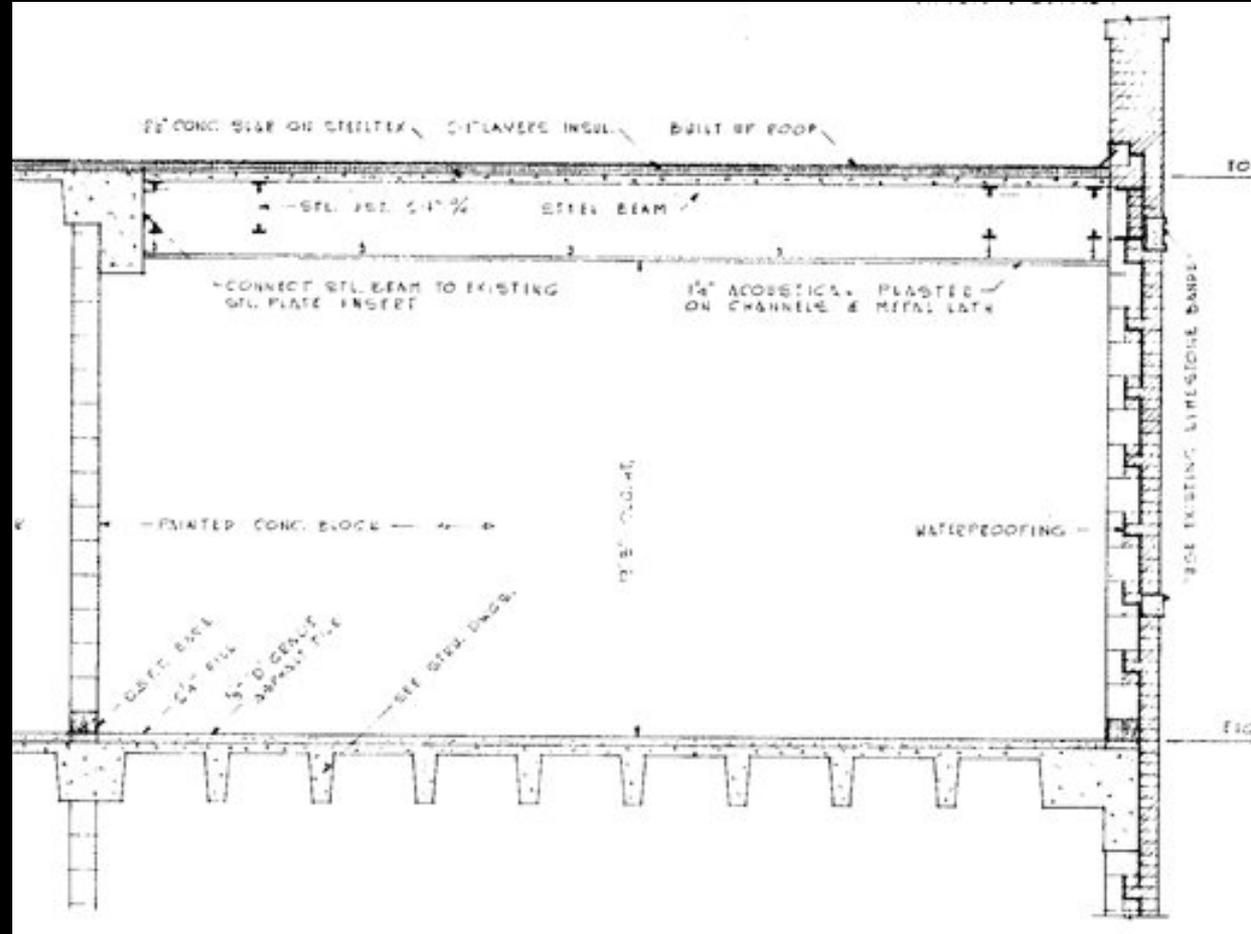
1958

- Modern framed construction:
 - The Walton Research Building



1958

- Modern framed construction:
 - The Walton Research Building



1958

- Modern framed construction:
 - The Walton Research Building



Every single one of these buildings has been damaged by one of the following causes.....

Damage to historic structures

- Natural disasters
 - Hurricanes, tornados, floods, earthquakes and insect infestation
- Manmade disasters
 - Fire, war
- Material movement under stress (“creep”)
 - Especially support settlement
- The big one: Water intrusion

Damage to structural materials

- Masonry
- Wood
- Iron and steel
- Concrete
- Soil

Masonry

- Deformation under stress
- Damage from corrosion of embedded iron
- Damage to masonry units
- Loss of mortar





03/24/2005



















11/02/2006



11/02/2006





11/02/2006



04 21 2004



#8

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L20003



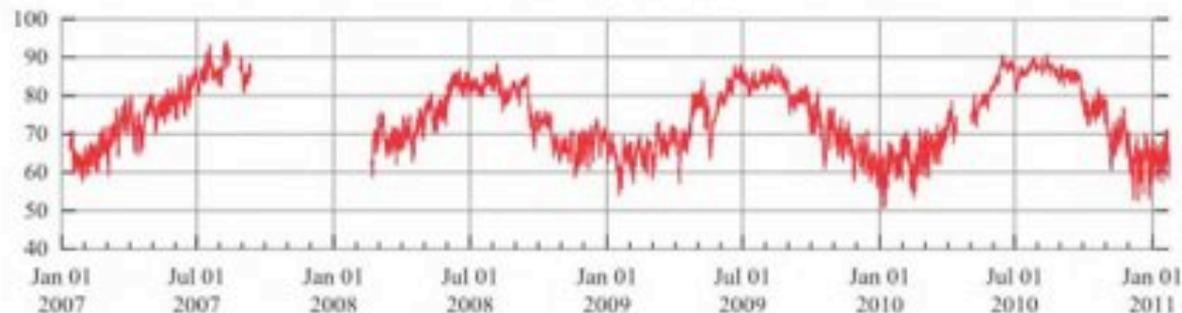
02/19/2008

Grace Church Structural Monitoring

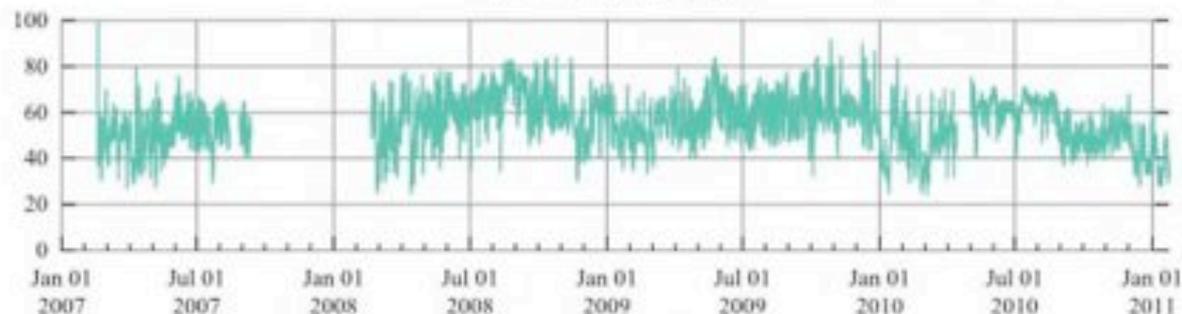
Long-Term Crack Displacement since beginning of project (January 1, 2007)

Note that LVDT-2A, LVDT-3, LVDT-4A, LVDT-5, LVDT-6, LVDT-12, and LVDT-15 were deactivated in August 2009.

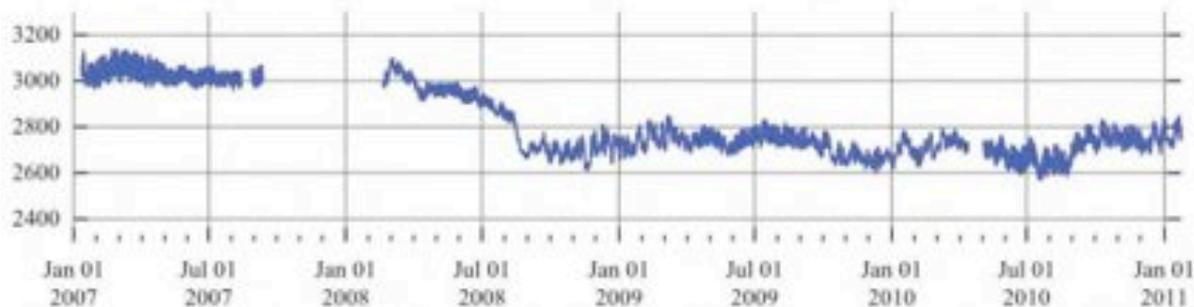
Indoor Temperature (°F)



Indoor Humidity (% RH)



LVDT-1: tower exterior, north wall (micrometers)



LVDT-2A: tower interior, north wall null (micrometers)

Wood

- Rot
- Insect infestation
 - Powderpost beetles
 - Subteranean termites
 - Formosan termites
 - Carpenter bees
- Overstress









Iron and steel

- Corrosion, particularly in contact with masonry





02/11/2005



02/11/2005



02/11/2005







Concrete

- Corrosion of reinforcing
- Loss of section





02 06 2004

Soil

- Overstress
 - Foundation movement and building settlement





Three examples

- 1820 Fort Washington, Maryland
 - Major structural issues due to water migration

Three examples

- 1833 First Baptist Church, Savannah, GA
 - Water intrusion from 1833 to 1922

Three examples

- 1849 Trinity Cathedral, Columbia, SC
 - Major damage to the trusses due to water intrusion

- 1820 Fort Washington, Maryland
 - Major structural issues due to water migration



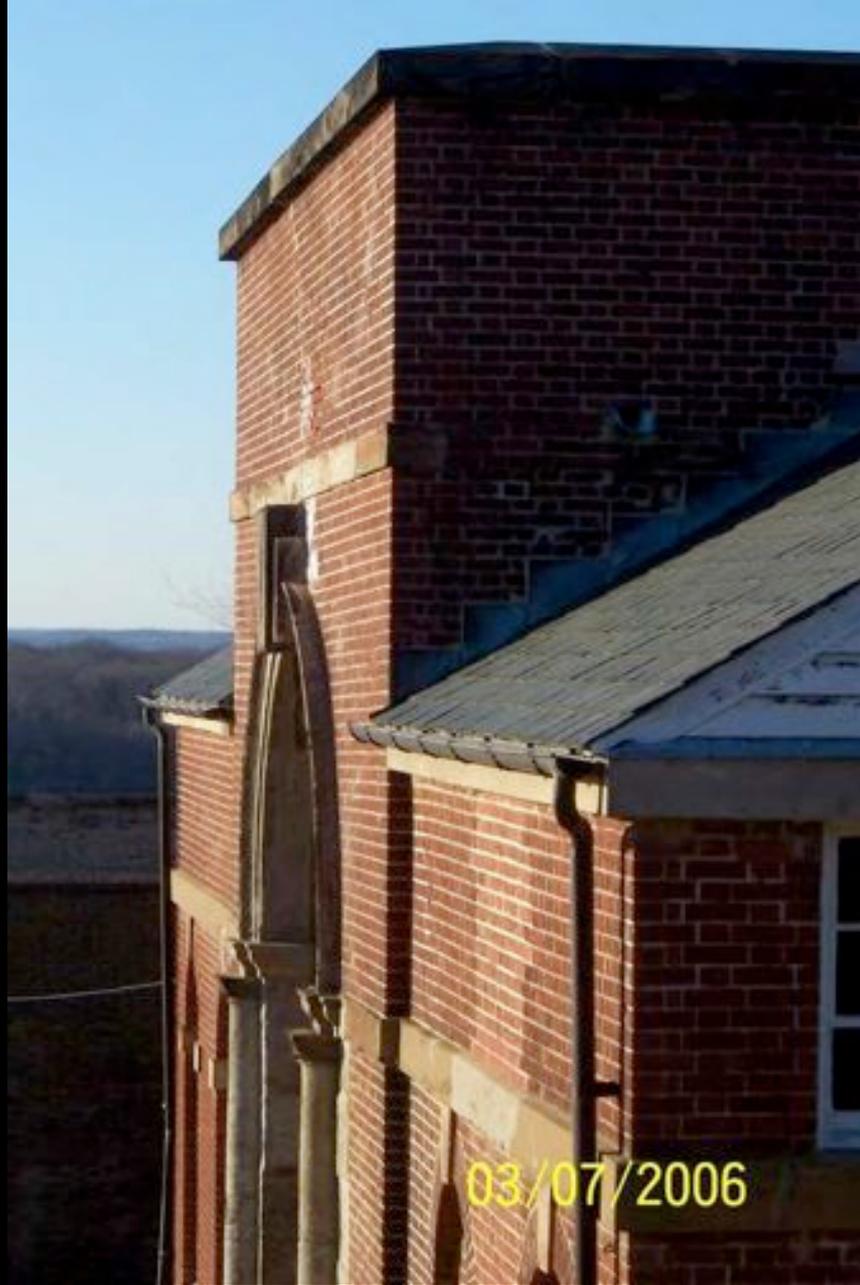












03/07/2006









1 2 3 4 5 6 7 8 9 10 11

MADE IN
U.S.A.

MADE IN U.S.A.
DATE: March 2004

07/06/2005





05/17/2005

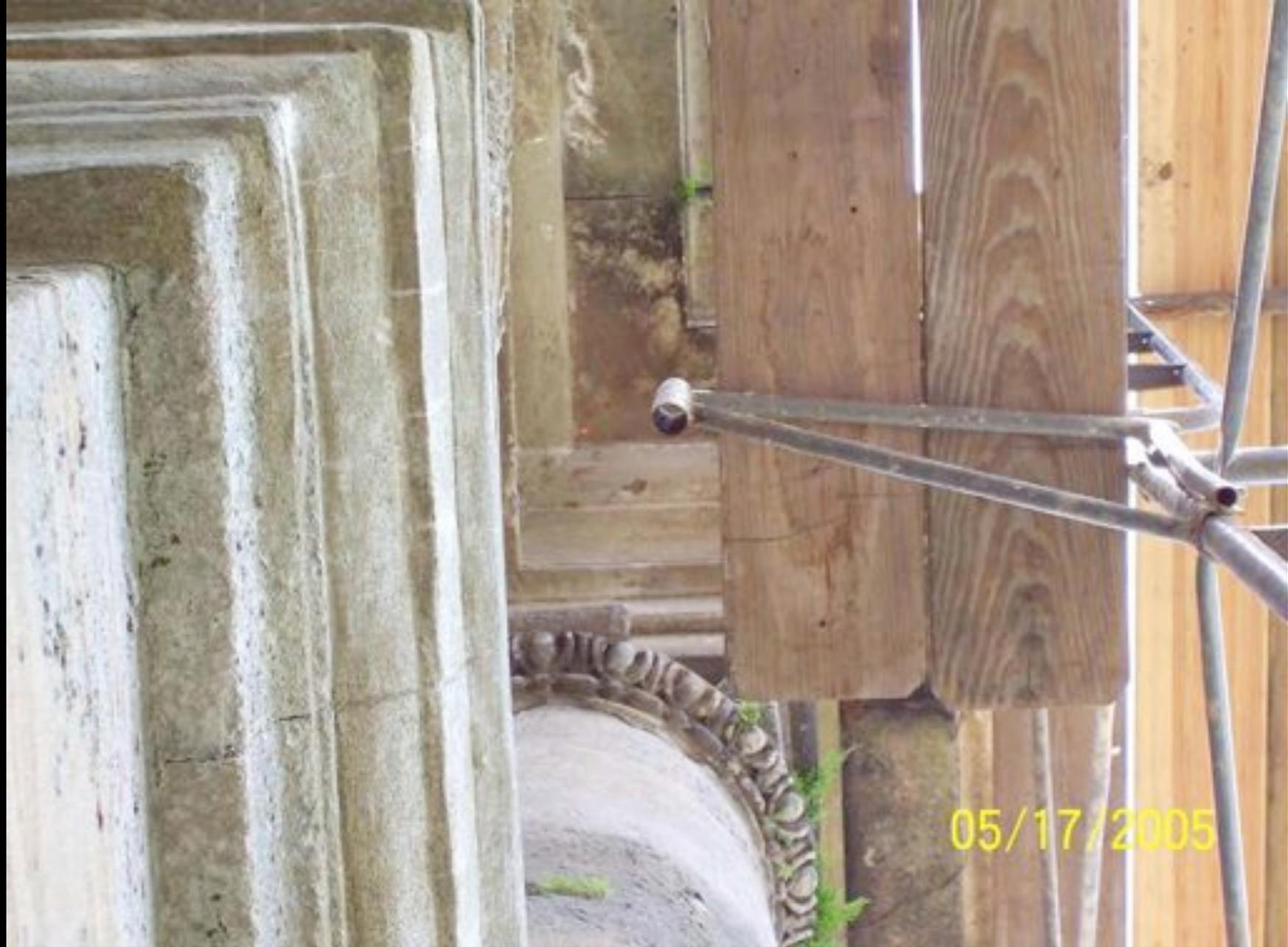


05/17/2005



05/17/2005



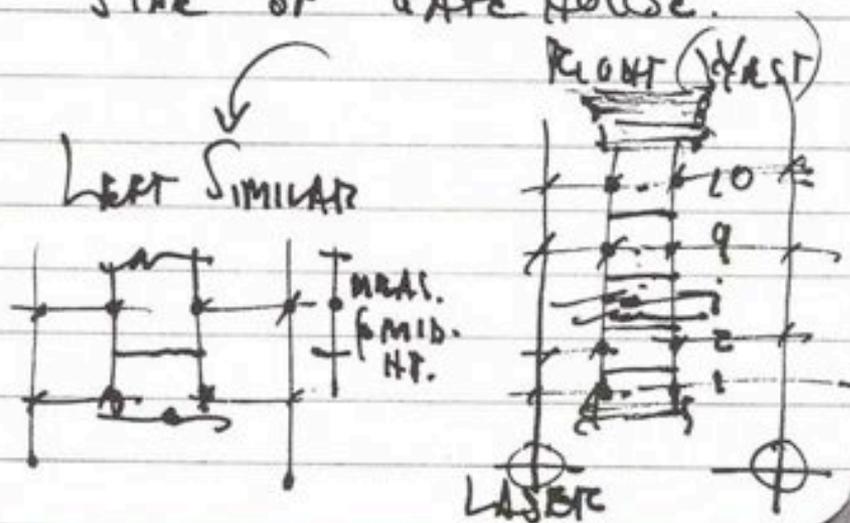


@ K. WANN

Tue MAY 17/2005

1. INITIAL CONCERN ABOUT
EAST ESTABLISHED WALL-MOVEMENT?
SUPPORT WAS LEVELLED...
MOVING IT TOWARD WALL

2. MEASUREMENTS ON SIDES
OF COLUMNS ON N.
SIDE OF GATE HOUSE.



MEASUREMENTS

	COL. LEFT (EAST)		COL. RIGHT (WEST)	
	L SIDE	R SIDE	L SIDE	R SIDE
10	7 1/4"	8 3/4"	8"	6 15/16"
9	6 1/8"	7 1/8"	6 1/2"	6 1/2"
8	5 15/16"	6 1/4"	5 7/8"	6 5/16"
7	6 1/4"	6 5/16"	5 7/8"	6 1/16"
6	6 1/16"	6"	5 3/4"	6"
5	6 5/16"	6 3/16"	5 5/8"	5 15/16"
4	6 1/4"	6"	5 11/16"	6 1/4"
3	6 3/16"	6"	5 11/16"	6 1/16"
2	6 1/16"	6 1/16"	5 5/8"	6"
1	6 1/4"	6 3/16"	5 3/4"	5 13/16"

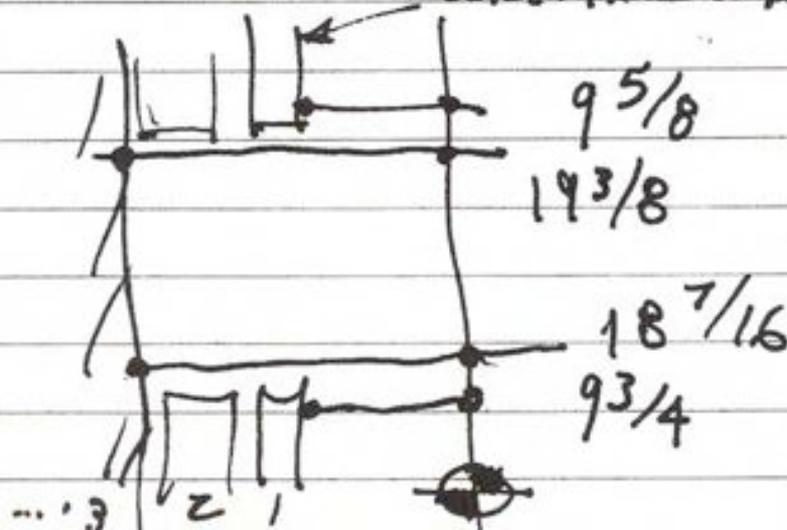
INSIDE HOLE (LOWER)

WY WY
1-2 1 3/4

WY WY
2-3 3 1/4"

LOWER HOLE:

OUTER FACE OF BRICK





Construction Materials Consultants

Whitehouse, Whitehouse Road, Stirling, FK7 7DA
Tel 01799 434708 Fax 01799 475133
E-mail cmc@cmcstirling.co.uk

Fort Washington Building Fabric Survey

*Appendix V – Main Gate
Commandant's Office, Sally Port & Guard House*

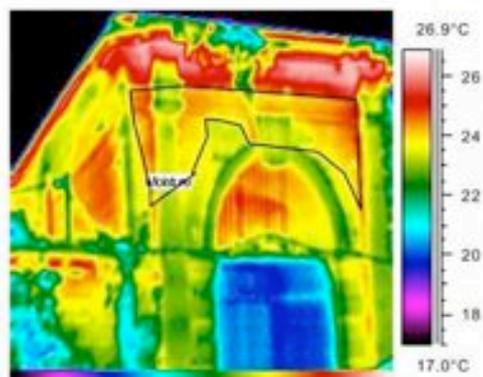
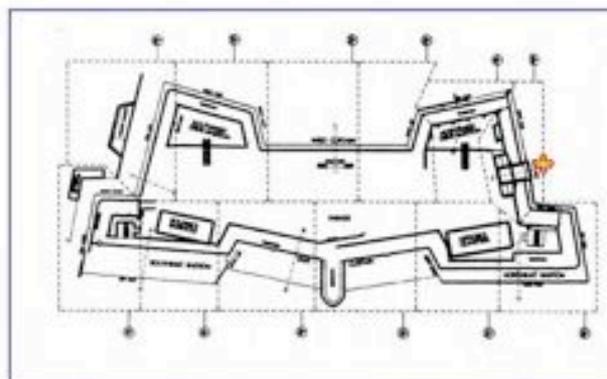
Infrared Thermography & Radar

Our Ref: M001740
Your Ref:
Doc. Ref: M0170001A1

Thermogram 1

Main Gate – North Elevation

North Elevation



The thermal anomalies in this image highlight areas affected by solar gain. These all tend to relate to areas below the parapet wall. This would suggest that the fill below the paved areas on the roof of the Sally Port has absorbed high levels of solar radiation. This occurs where the fill material has a high moisture content increasing the rate at which solar gain is absorbed.

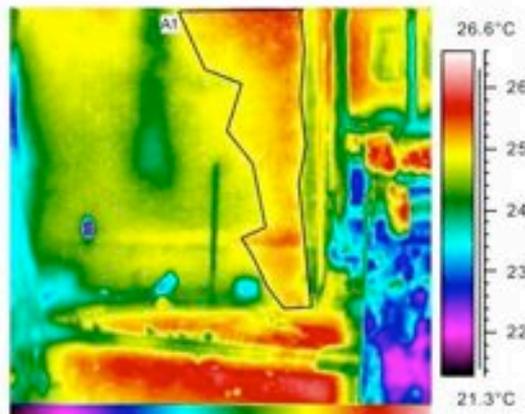
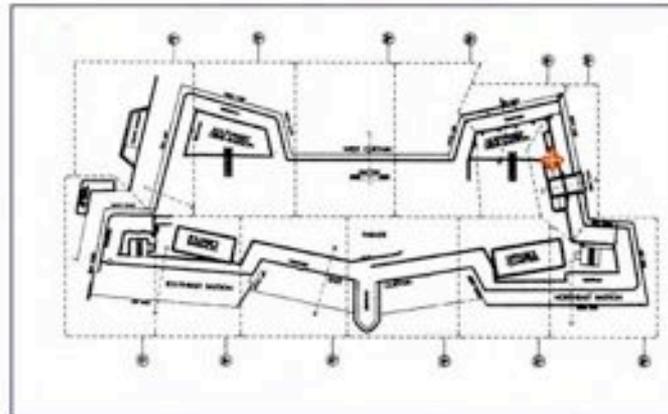
The migration of heat down to the lower levels of the masonry would suggest that moisture is also draining down through the building fabric.

Thermogram 5

Main Gate – West Elevation

West Elevation – Gatehouse, guardhouse

(Recorded 2 July 2002 – 08:52)



The anomaly highlighted here, is an extension of the anomaly shown in thermogram 4 and connects with the anomaly below the first floor stringcourse.

Floor 1

Radar Scan Locations

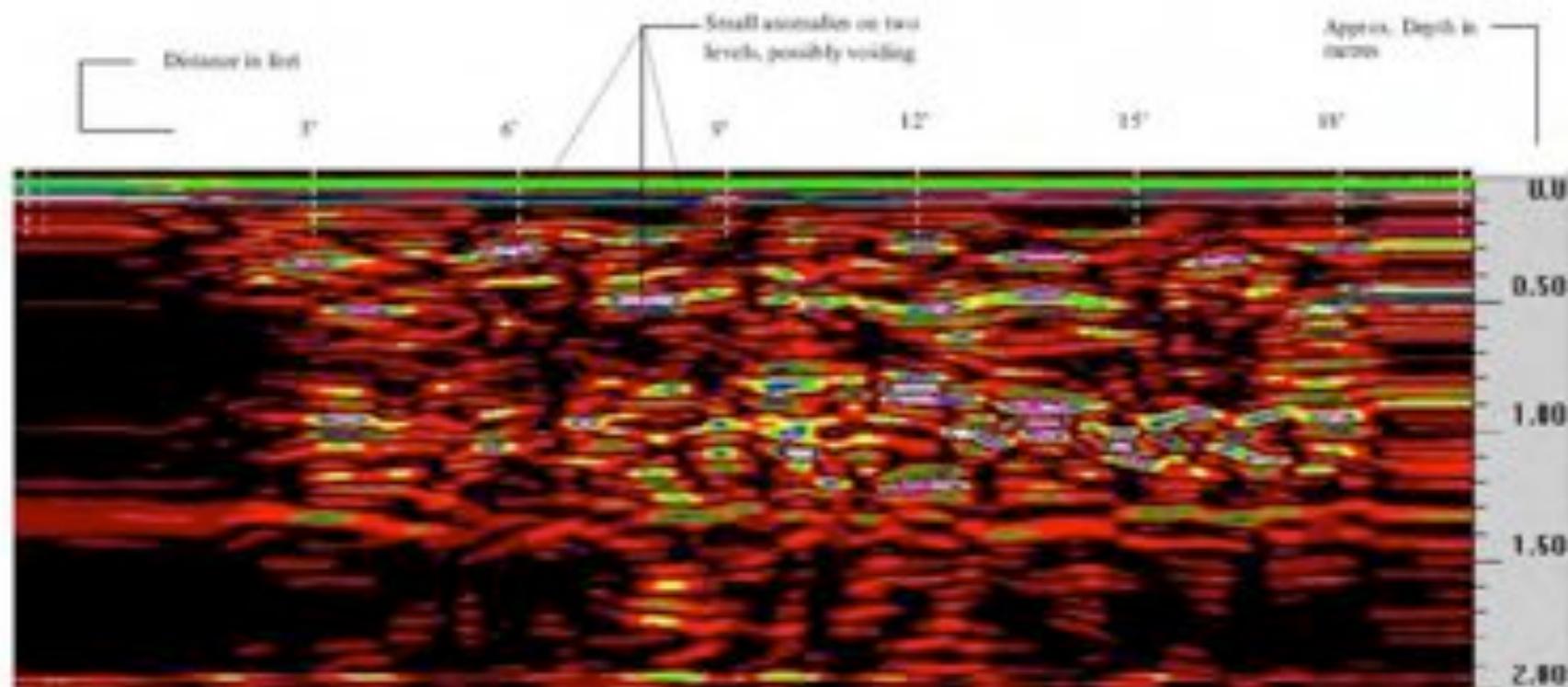


Radar Scan E01 top of staircase /
stair & first floor above that

Arrow on Radar Scan show this

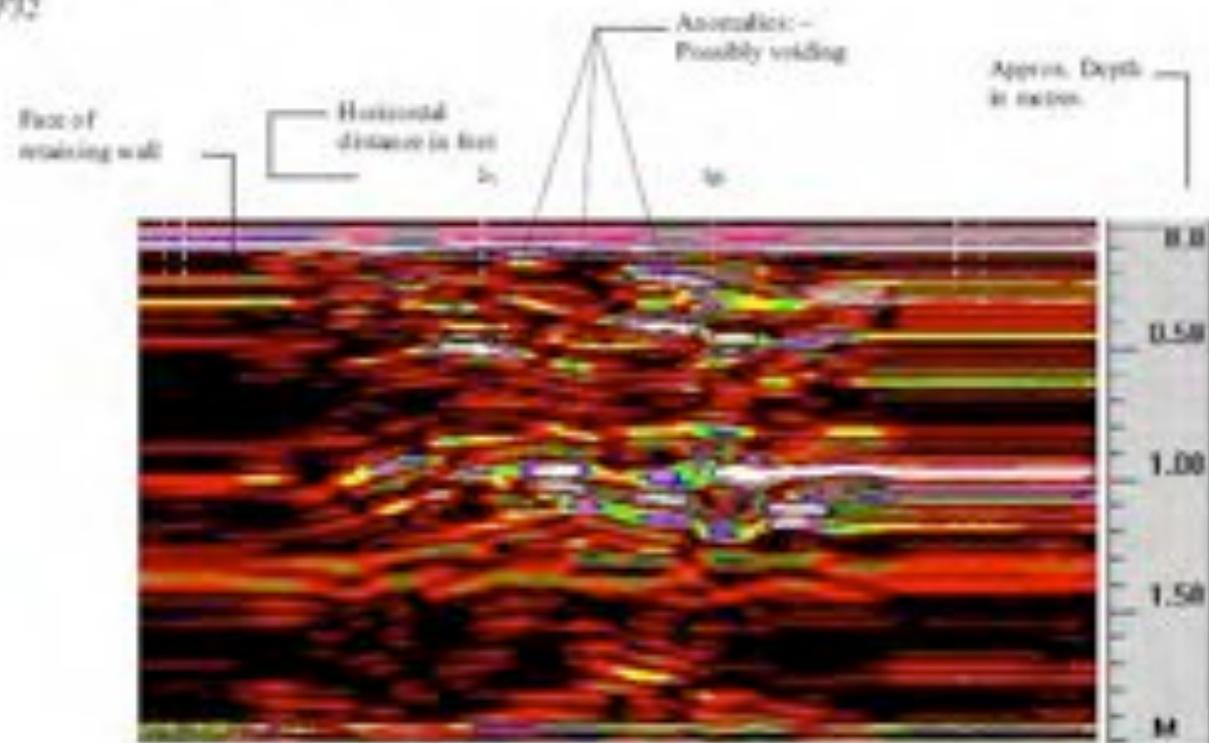


Radar File F31



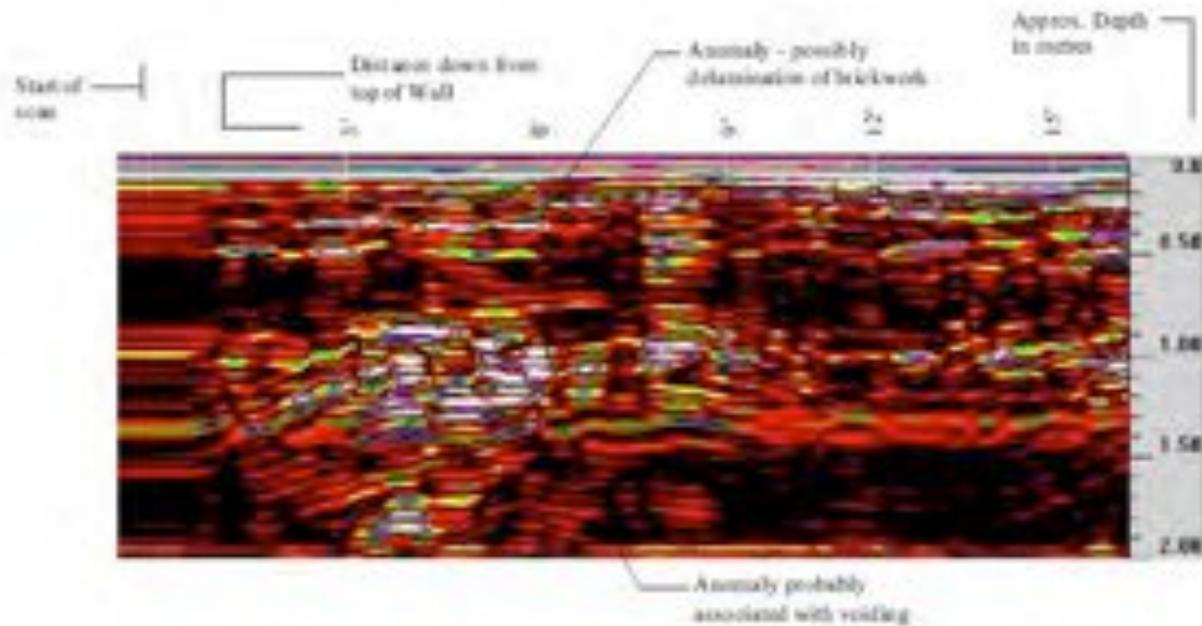
A vertical core taken down through the brick paving and into the mortar masonry infill confirmed that voids were present both within the brick layers and in the underlying mortar masonry.

Radar File F12



Comments for Radar File F12

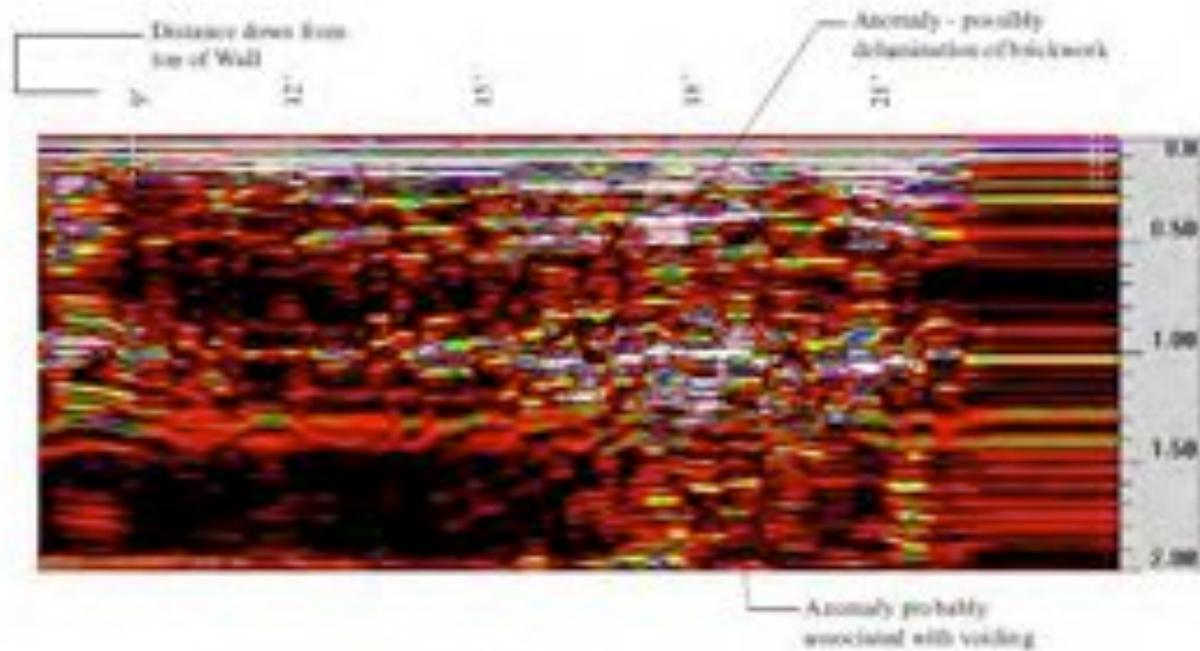
Radar File F29 Part 1



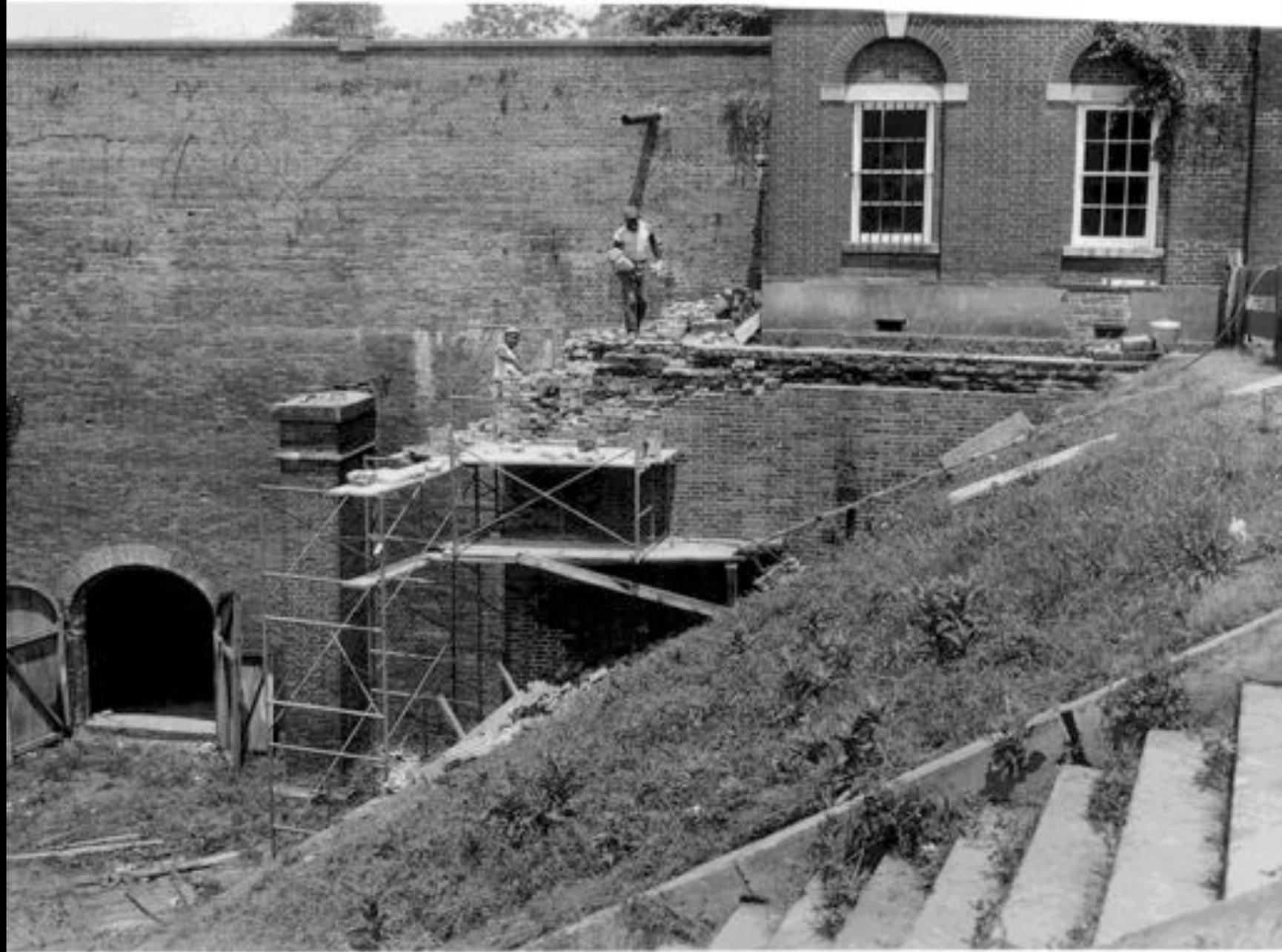
Vertical scan down west face of retaining wall on west side of gatehouse.

The voiding indicated in the radar trace was confirmed by coring to be related to a separation within the brickwork and, at depth, to voiding in the masonry infill.

Radar File F29 Part 2



Continued as for Radar File F29 Part 1.







07/05/2005





07/05/2005









07/05/2005





05/16/2005



07/05/2005



07/05/2005



07/05/2005





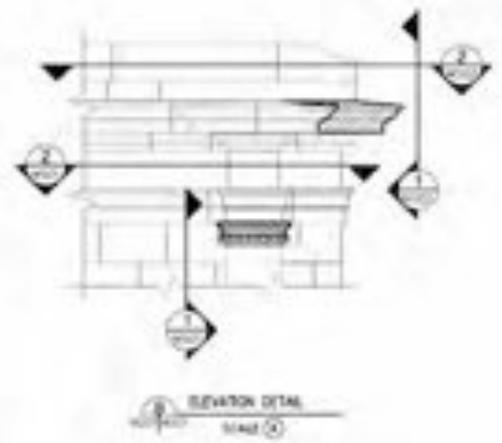
Construction Materials Consultants

Walton House, Whitehouse Road, Salford, M47 7TA
Tel 01796 434708 Fax 01796 475133
E-mail cmc@constructionmaterials.co.uk

Fort Washington Building Fabric Survey

Our Ref: M001740
Your Ref:
Doc. Ref: M01870303A1

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GENERAL NOTES

GENERAL NOTES

DEPARTMENT OF STATE



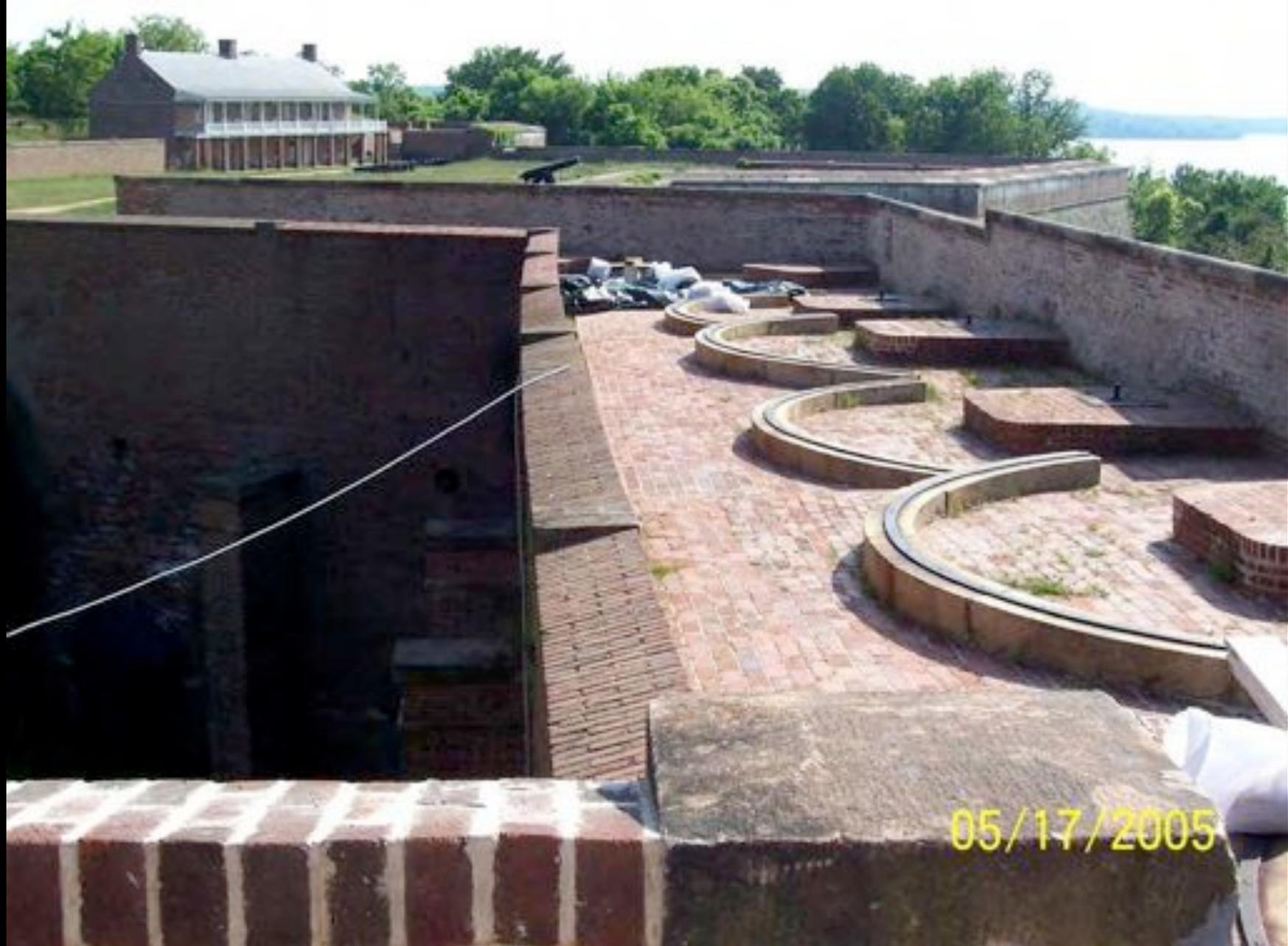
SCALE ①  SCALE OF FEET

SCALE ②  SCALE OF FEET



SHEET NO. M201	PROJECT NO. 	TITLE GATHOUSE ELEVATION	DATE
DRAWN BY 			CHECKED BY
PROJECT LOCATION 			SHEET NO. 32 - 28







08/02/2005





12/06/2005



12/05/2005







10/13/2006



10/13/2006











07/05/2006



07/05/2006





08/02/2005













- 1833 First Baptist Church, Savannah, GA
 - Water intrusion from 1833 to 1922

- *Structural problems within the roof of the church: What we've found and what we recommend*
- *Specifics of work on First Baptist*

Part I:

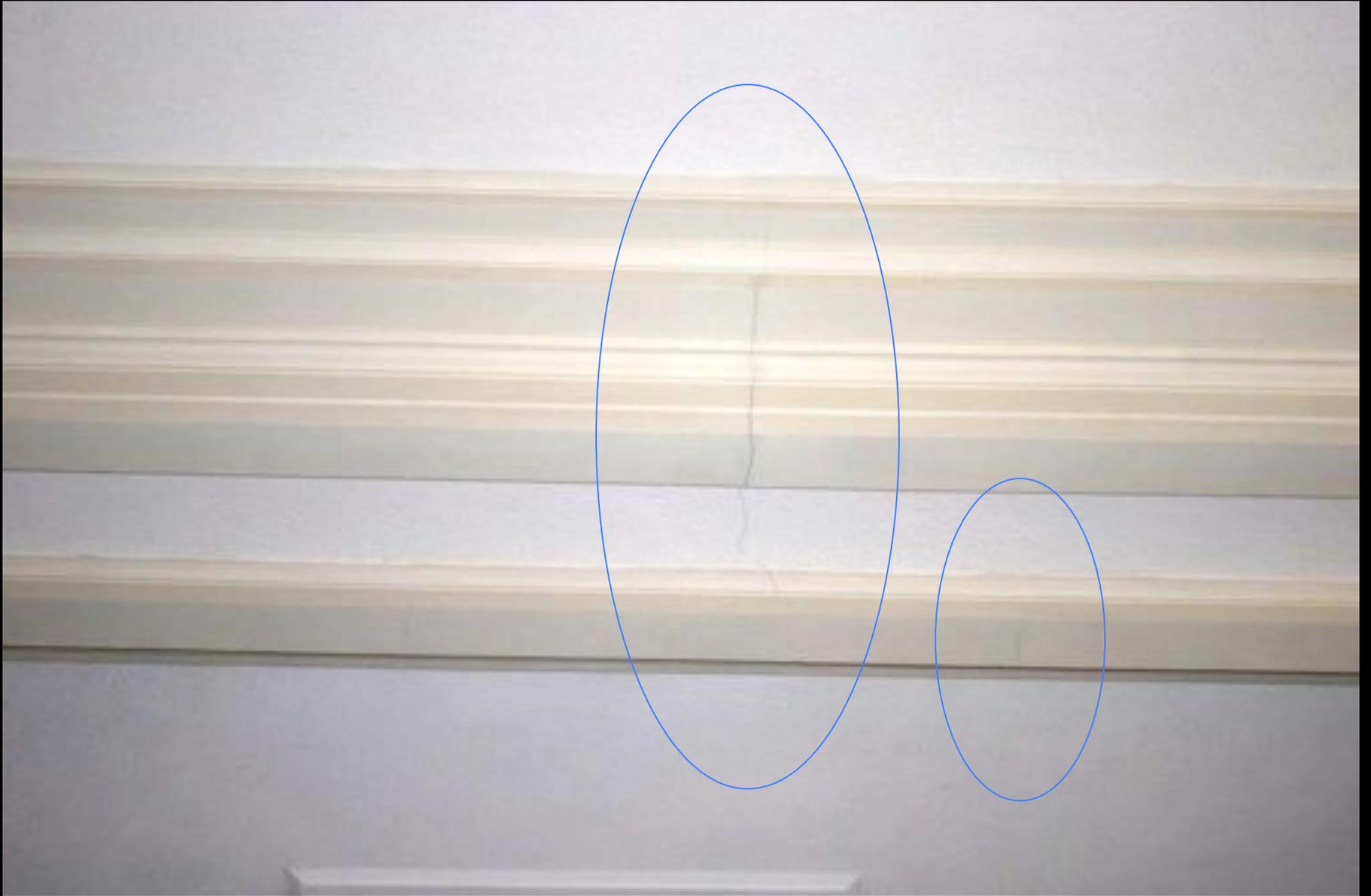
- Initial Concerns*
- Historical Overview*
- General Construction Technology*
- Findings, Conclusions, Recommendations*

Initial Concerns: Why we were called in



INITIAL CONCERNS

Plaster Cracking



INITIAL CONCERNS



INITIAL CONCERNS



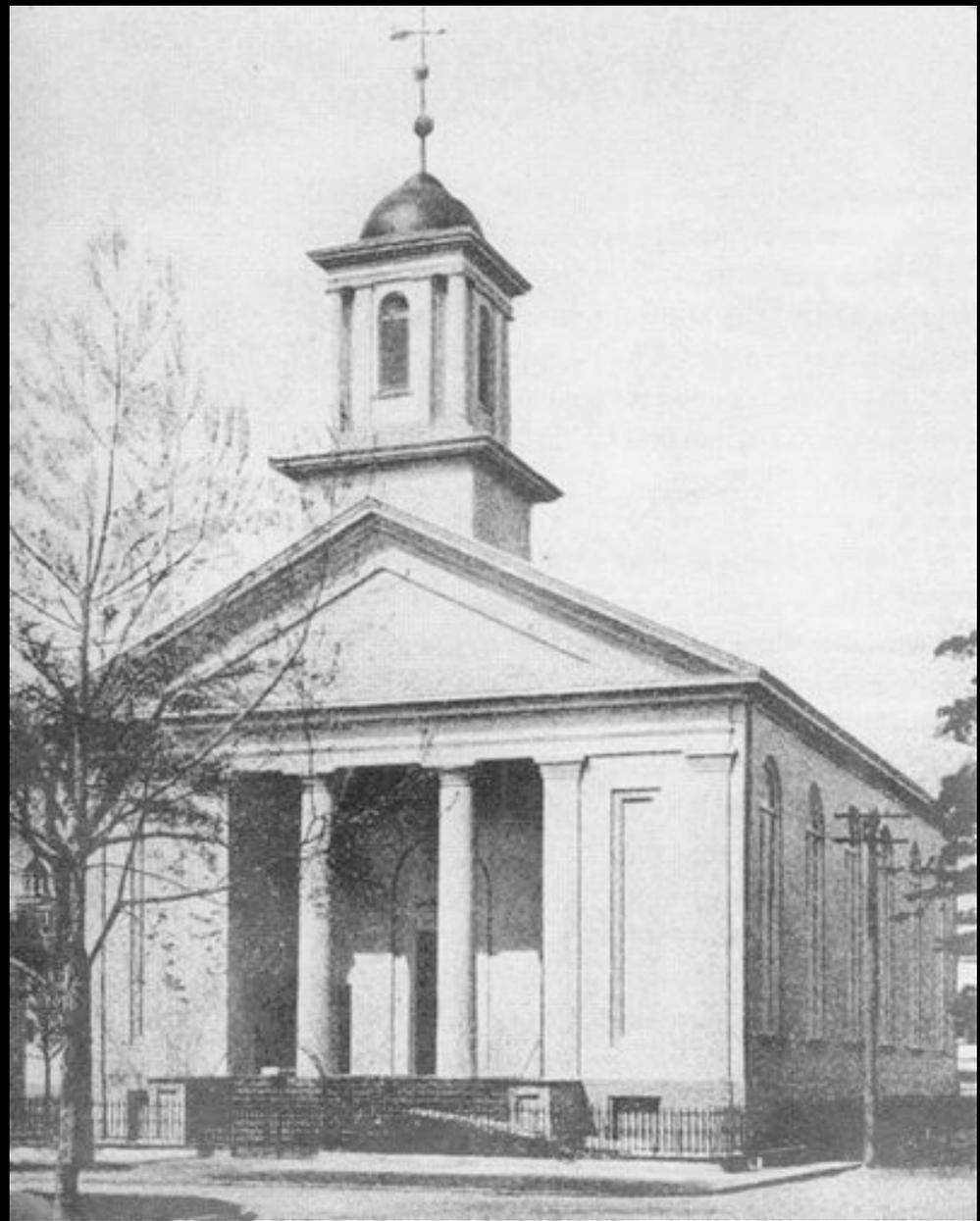
INITIAL CONCERNS



INITIAL CONCERNS

Historical Overview

Building completed, 1833
Designed by architect, Elias Carter



HISTORICAL OVERVIEW

1897 Hurricane Damage



1897 Hurricane Damage



HISTORICAL OVERVIEW



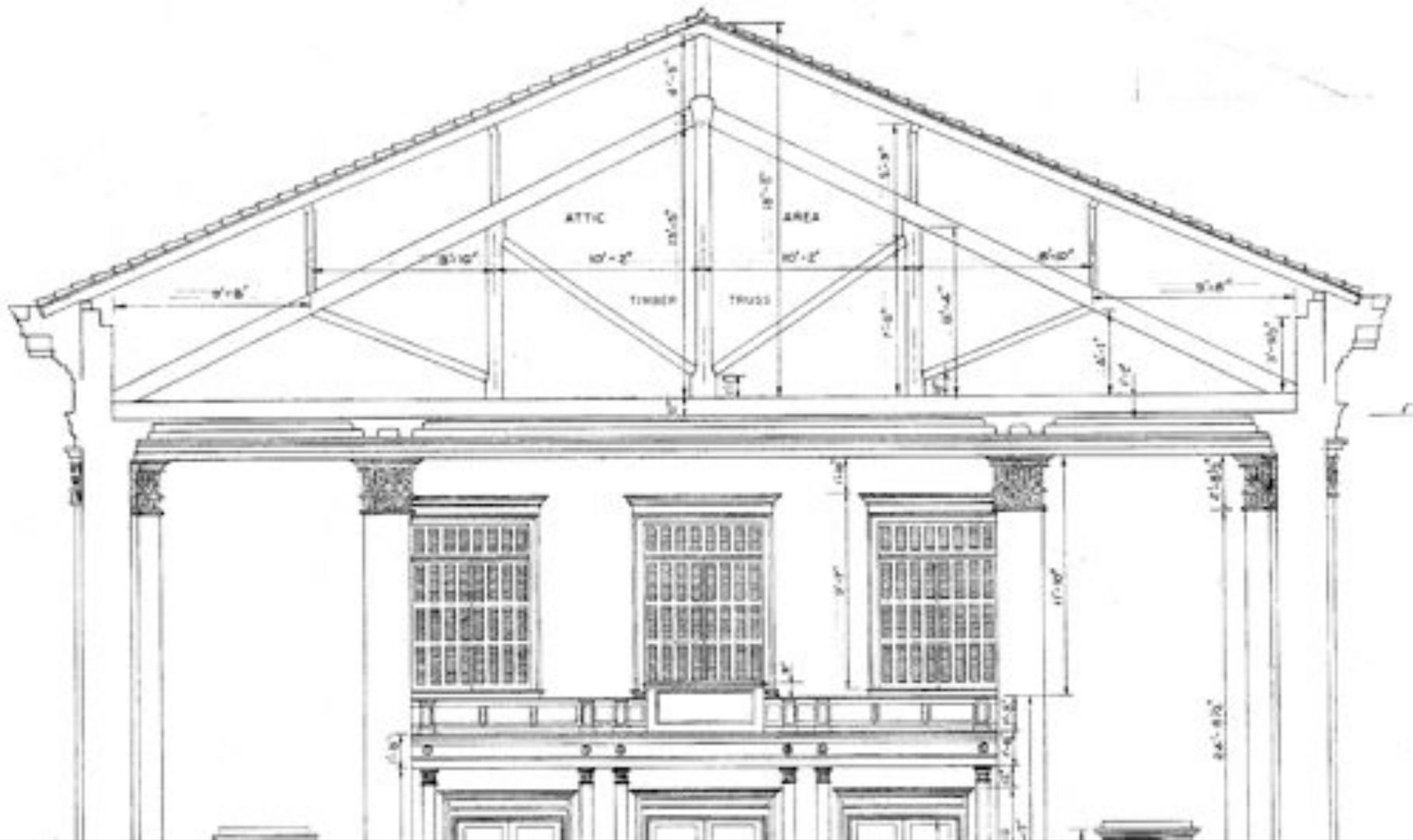
- 1921-1922
Renovations

- Architect, Henrick
Wallin

- Cupola removed,
portico enclosed,
new portico added,
and the entire
façade clad in cast
stone

HISTORICAL OVERVIEW

General Construction Technology







On-site Investigation:

- Findings by observation*
- Findings by measurement*
- Findings by testing*
- Findings by computation*

Findings by Observation

Roof line Deformation



FINDINGS

Roof line Deformation

Truss 2

Truss 1

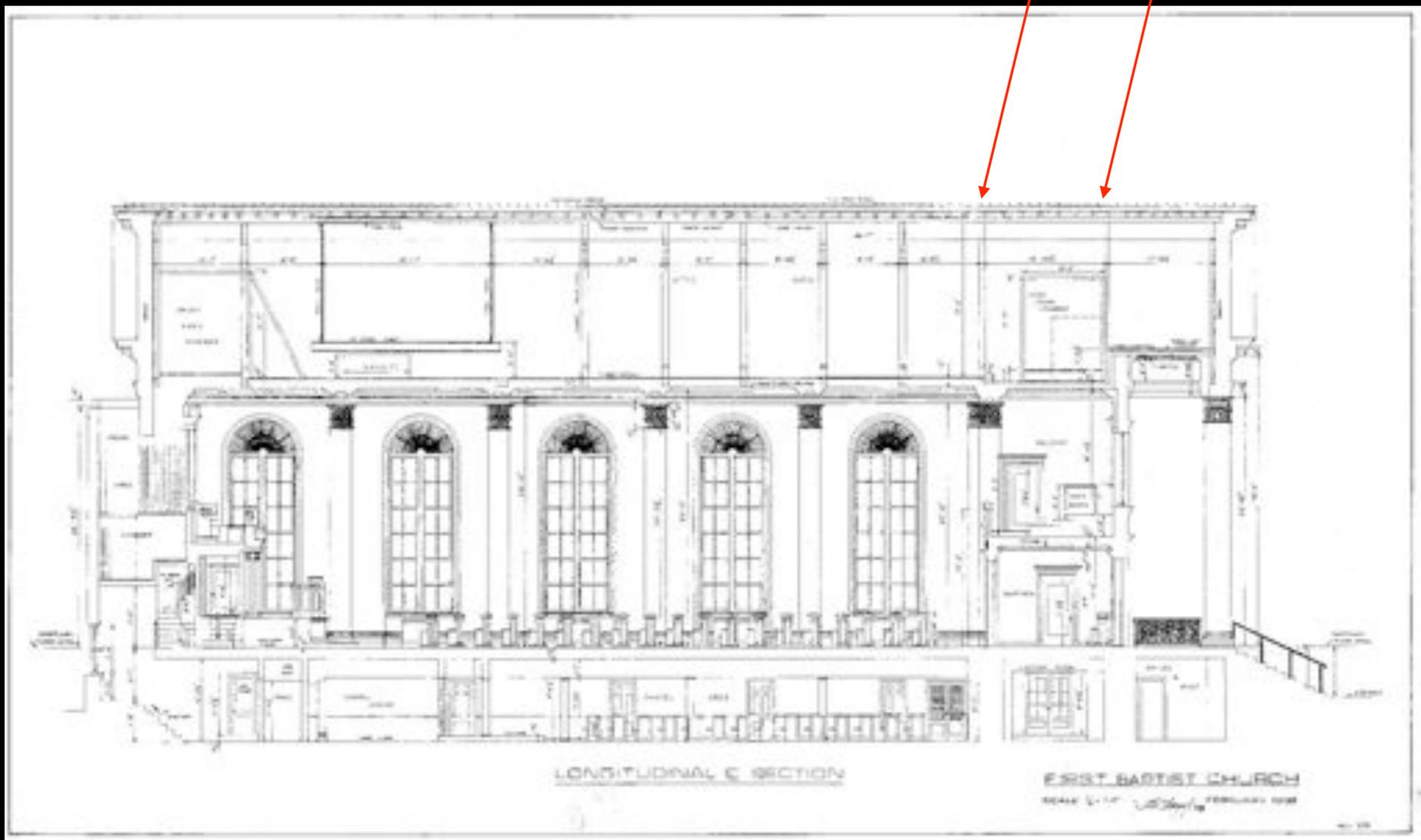


FINDINGS

Roof line Deformation

Truss 2

Truss 1



FINDINGS

Significant Truss Loads: Roof Loads



Ceiling Deflection: Soffit Over the Balcony Rail



FINDINGS

Plaster Cracking



FINDINGS

Cracking of the Pilasters



Cracking of the Pilasters



Plaster Cracking



FINDINGS

Plaster Cracking



FINDINGS

Plaster Cracking



FINDINGS

Significant Truss Loads: Ceiling Plaster



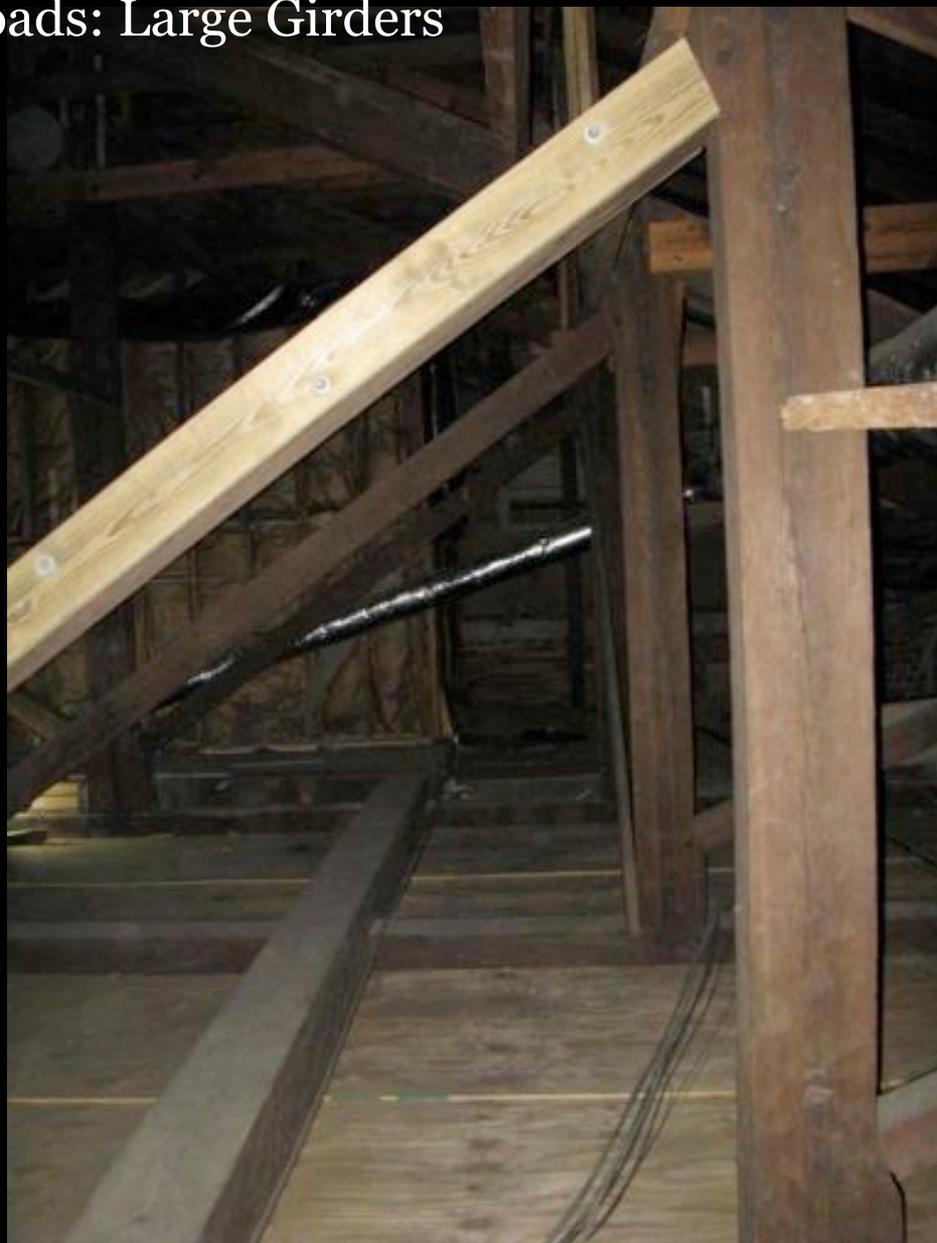
Ceiling Deflection: Sanctuary



Significant Truss Loads: Large Girders



Significant Truss Loads: Large Girders



Significant Truss Loads: Large Girders



Significant Truss Loads: Organ Room



FINDINGS

Significant Truss Loads: Organ Room



FINDINGS

Significant Truss Loads: Additional Roof Framing



FINDINGS

Bending of Bolts and Wooden Dowels



FINDINGS

Lightly Structured Truss 1



FINDINGS

Lightly Structured Truss 1



FINDINGS

Lightly Structured Truss 1



FINDINGS

Sealed Truss Ends



Sealed Truss Ends



Signs of Water Infiltration



Signs of Water Infiltration



FINDINGS

Investigation of Damage and Deterioration of Trusses



FINDINGS

Investigation of Damage and Deterioration of Trusses



FINDINGS

Investigation of Damage and Deterioration of Trusses



FINDINGS

Deterioration: Truss Ends



Deterioration: Truss Ends



FINDINGS

Termite Damage



FINDINGS

Termite Damage



FINDINGS

Termite Damage



FINDINGS

Termite Damage



FINDINGS

Checking of Truss Members



FINDINGS

Checking of Truss Members



FINDINGS

Splitting of Truss Members



FINDINGS

Splitting of Truss Members



FINDINGS

Findings by Measurement

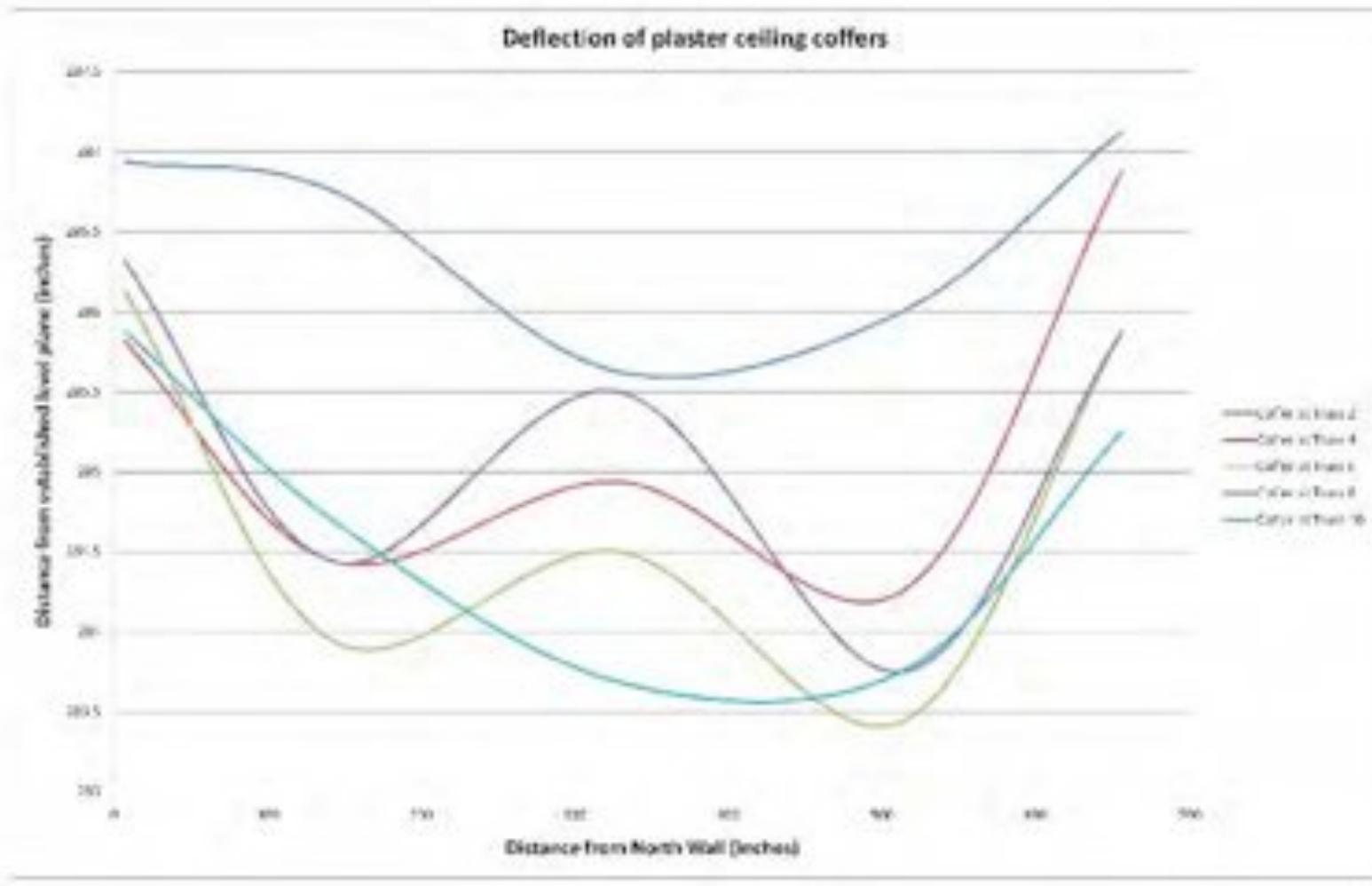
Ceiling Deflection: Sanctuary



Site Measurements: Sanctuary Interior



Ceiling Deflection Measurements



Note: Measurements for deflection recorded on October 3, 2008 using laser measure and laser level. Benchmark at 51 7/8" above floor. Vertical distance measured from construction ceiling.

Site Measurements: Attic Interior



FINDINGS

Site Measurements: Attic Interior



FINDINGS

Deflection and Separation of Truss Members



FINDINGS

Deflection and Separation of Truss Members



FINDINGS

Deflection and Separation of Truss Members



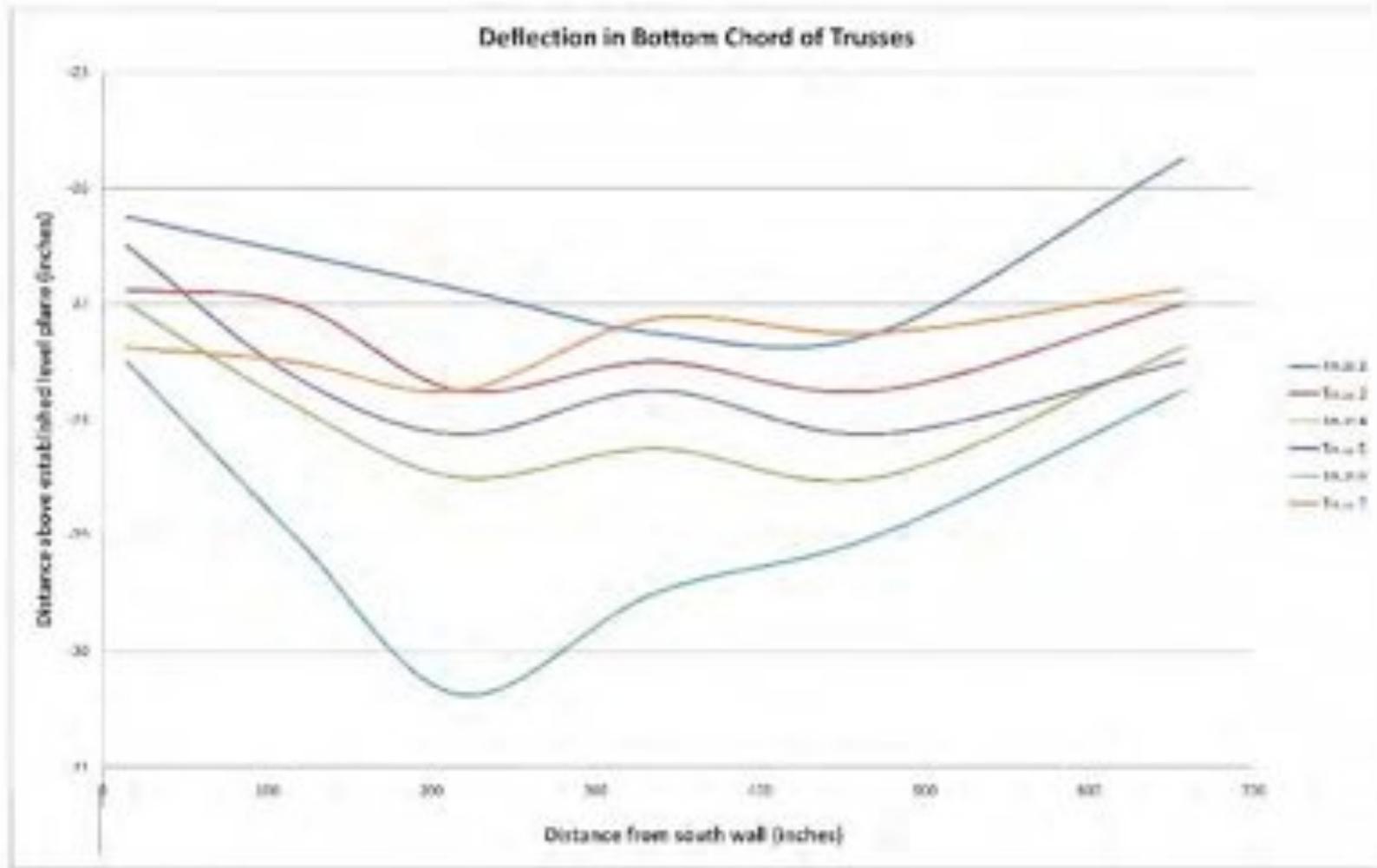
FINDINGS

Separation of Truss Members



FINDINGS

Truss Deflection Measurements



Note: Measurements for deflection recorded October 3, 2005 using laser measure and laser level. Benchmark at 27 5/16" above bottom chord of truss (top of iron strap on west face of truss 2).

Findings by Testing

Resistance Drilling

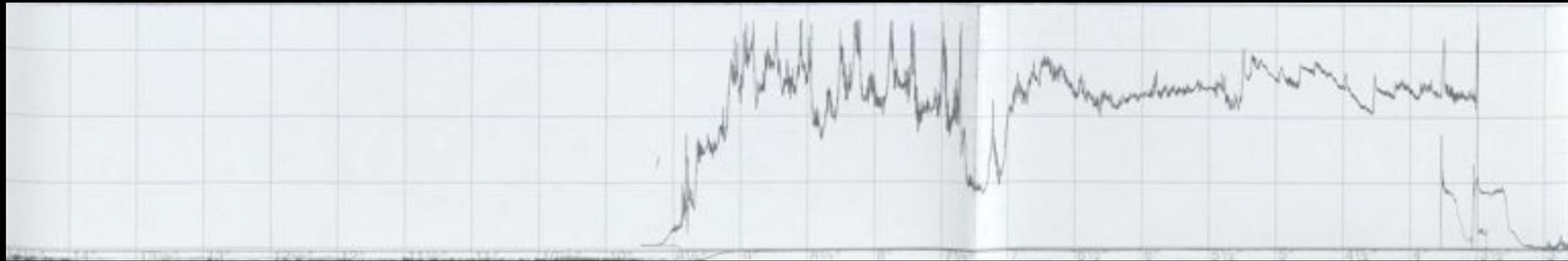


Resistance Drilling

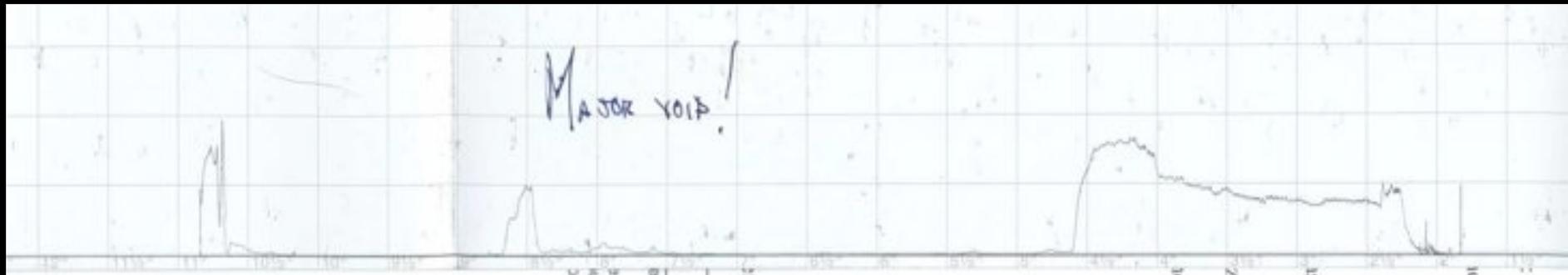


FINDINGS BY TESTING

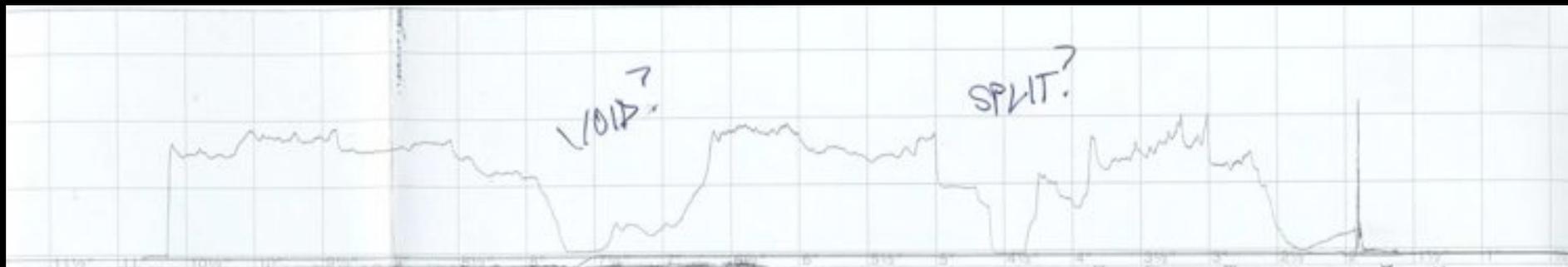
Results from Resistance Drilling



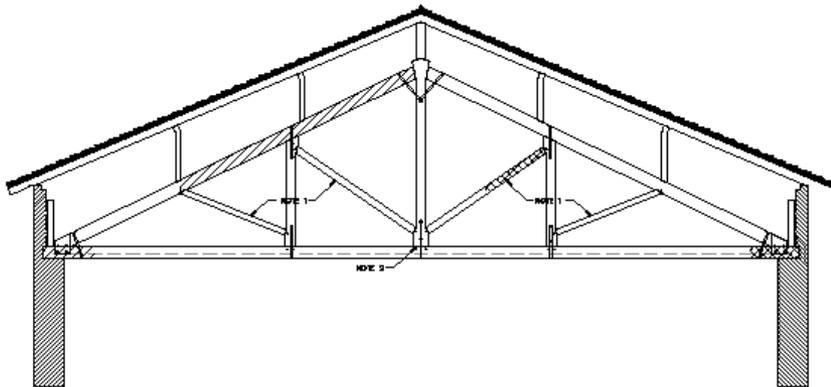
Truss 2: North end, west face



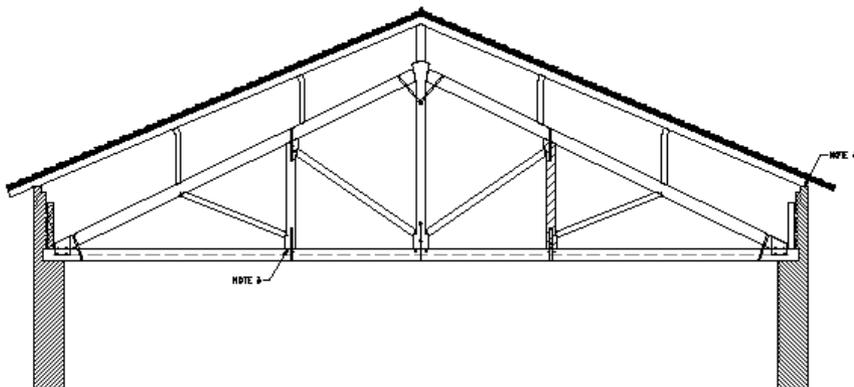
Truss 3: North end, east face



Truss 5: South end, west face



TRUSS 4 LOOKING WEST (A)
1/4" = 1'-0"



TRUSS 4 LOOKING EAST (B)
1/4" = 1'-0"



PROJECT NO. 07-080
DATE AUGUST 20, 2008

NO. 1

NO. 2

NO. 3

- EXISTING IN MEMBER
- MISSING IN MEMBER
- TYPICAL DAMAGE

1. EXISTING MEMBERS INDICATED WITH SOLID LINES, AT 3/8" DIA. OR 1/2" DIA. AT 3/4" O.C. ARE TO REMAIN UNLESS OTHERWISE NOTED.
2. MISSING MEMBERS ARE INDICATED WITH DASHED LINES FROM JOINT TO JOINT.
3. 1/4" INDICATION - 2 PLYS 5/8" DIA. CIRCULAR STUDS.
4. TYPICAL DAMAGE TO ROOF JOINTS, STUDS AND SHEATHING.

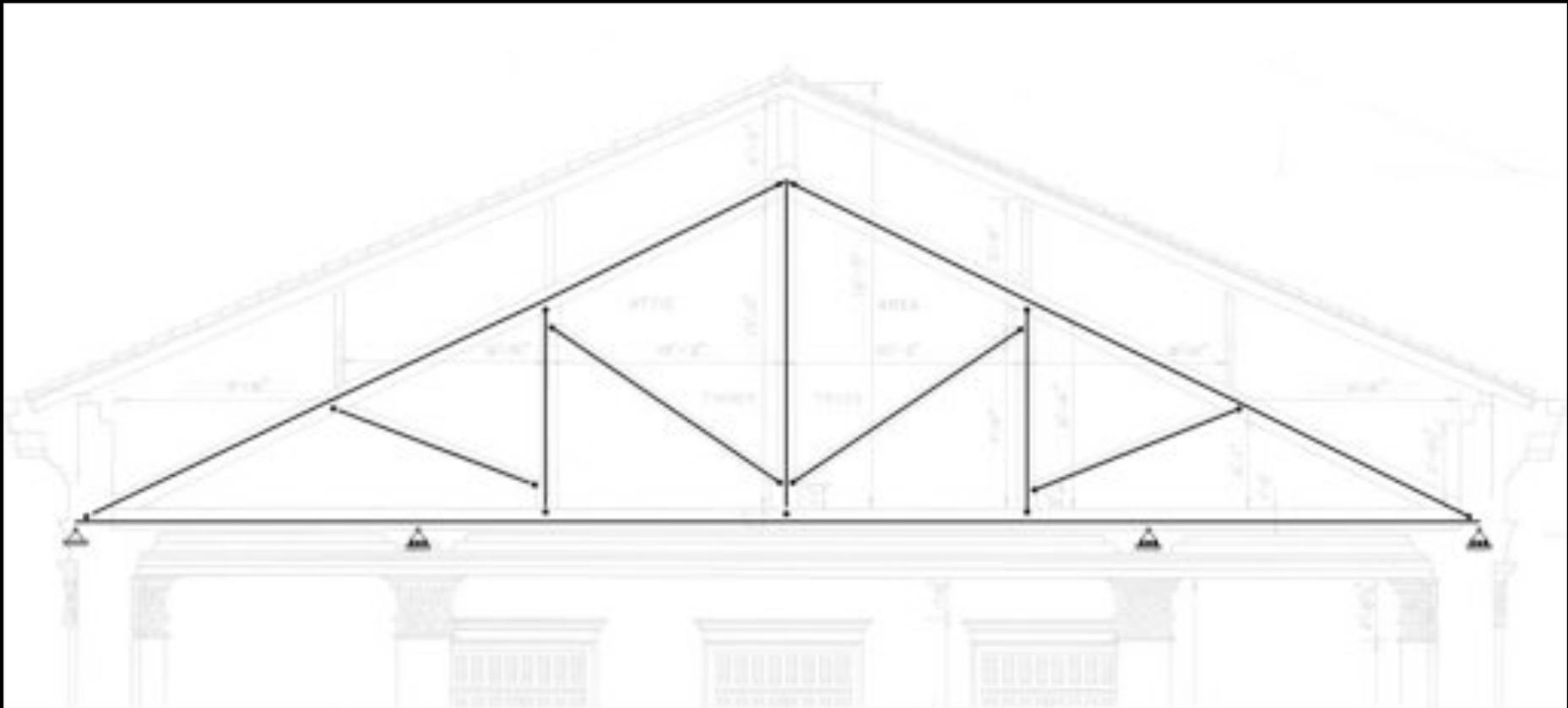
NO.	DATE	REVISION

First Baptist Church
Savannah, GA

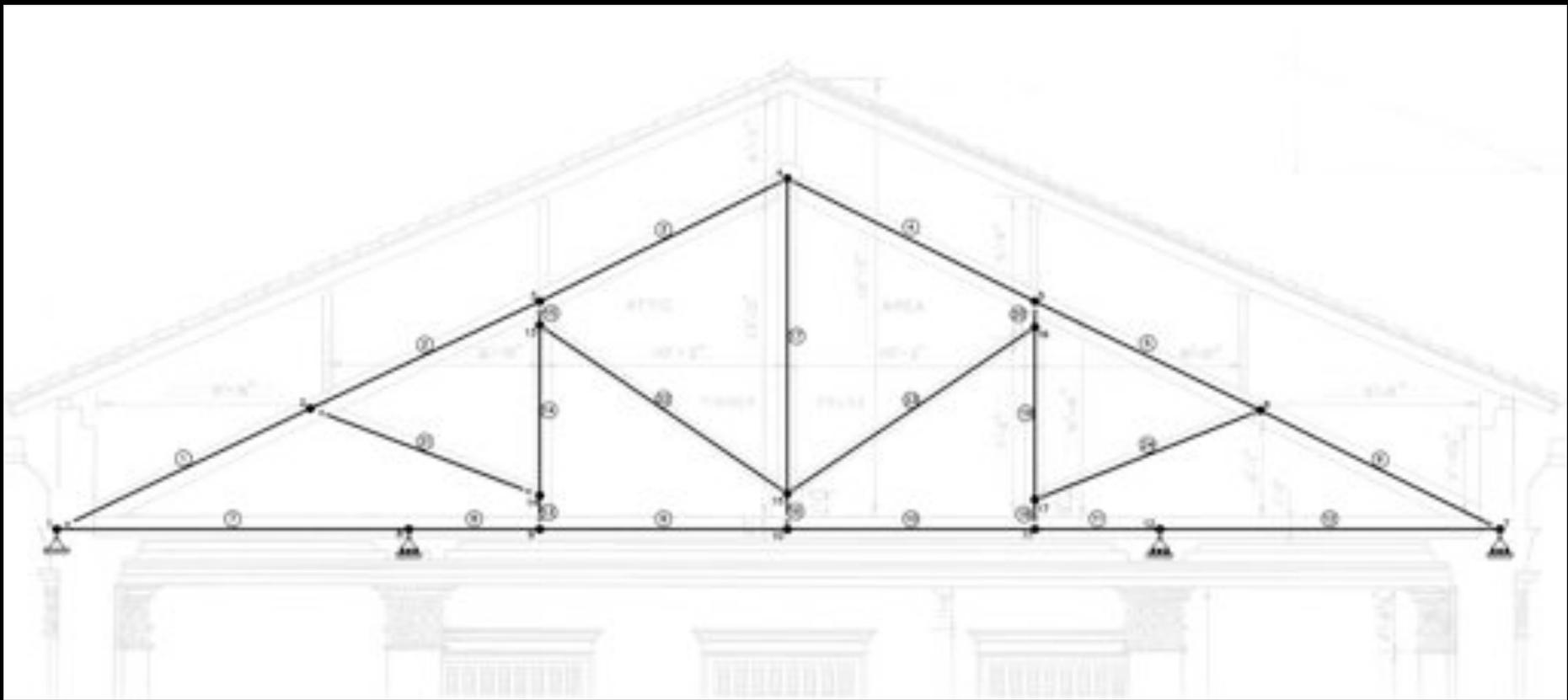
TRUSS 4

PROJECT NO. 07-080
DRAWN BY TBA
CHECKED BY JCB
DATE AUGUST 20, 2008
PROJECT NO. 07-080

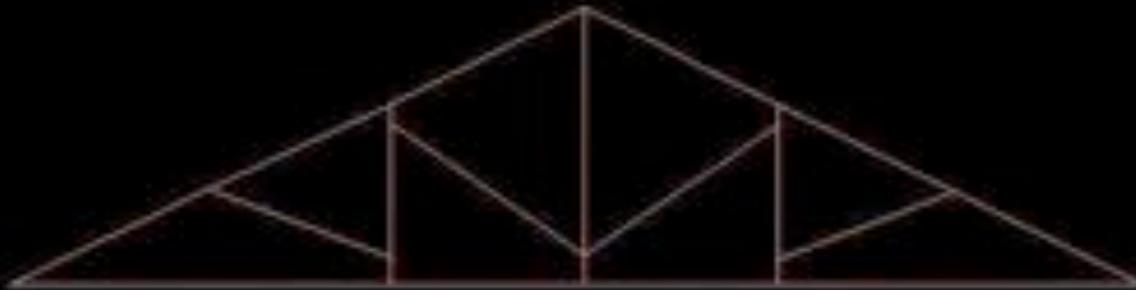
Findings by Computation



FINDINGS BY COMPUTATION



FINDINGS BY COMPUTATION



FINDINGS BY COMPUTATION



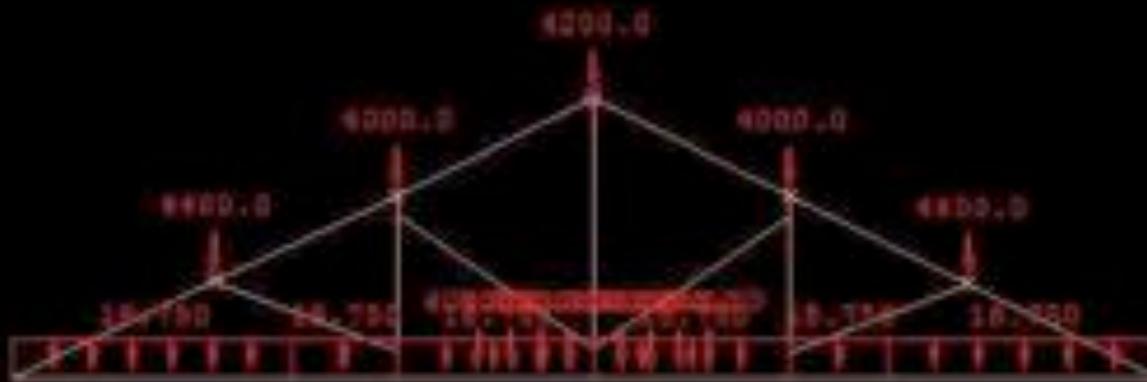
FINDINGS BY COMPUTATION

APPLIED LOAD 1:



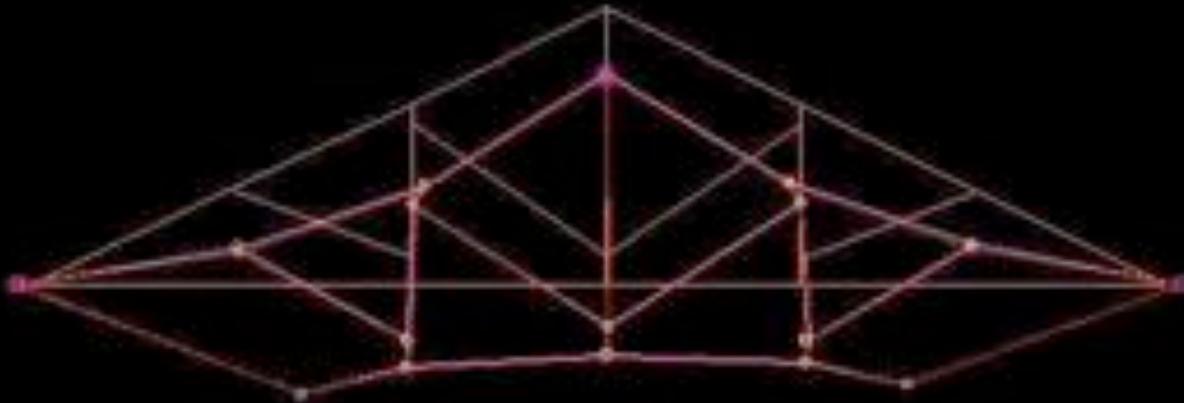
FINDINGS BY COMPUTATION

APPLIED LOAD 2



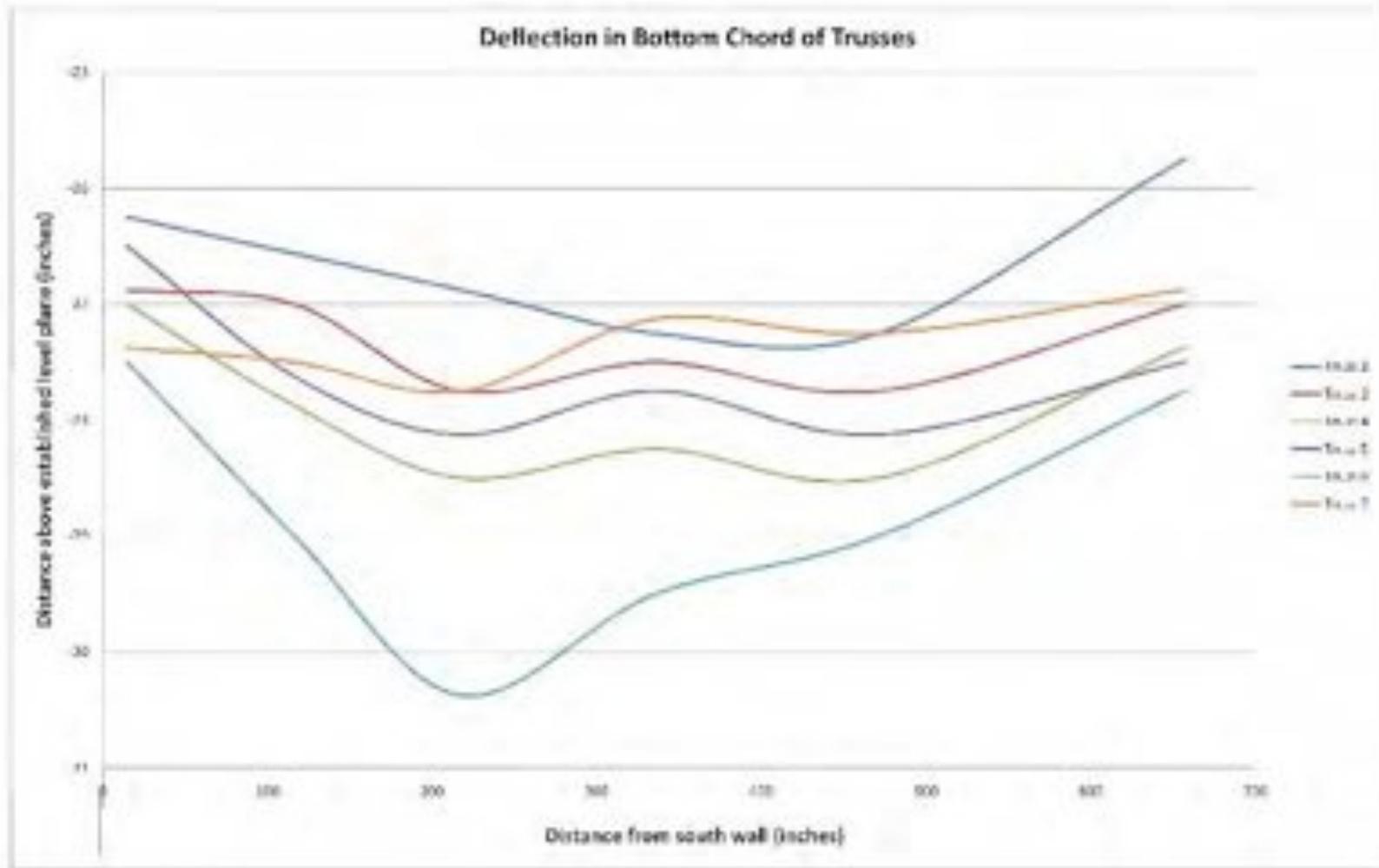
FINDINGS BY COMPUTATION

**LOAD DEMAND:1019.07



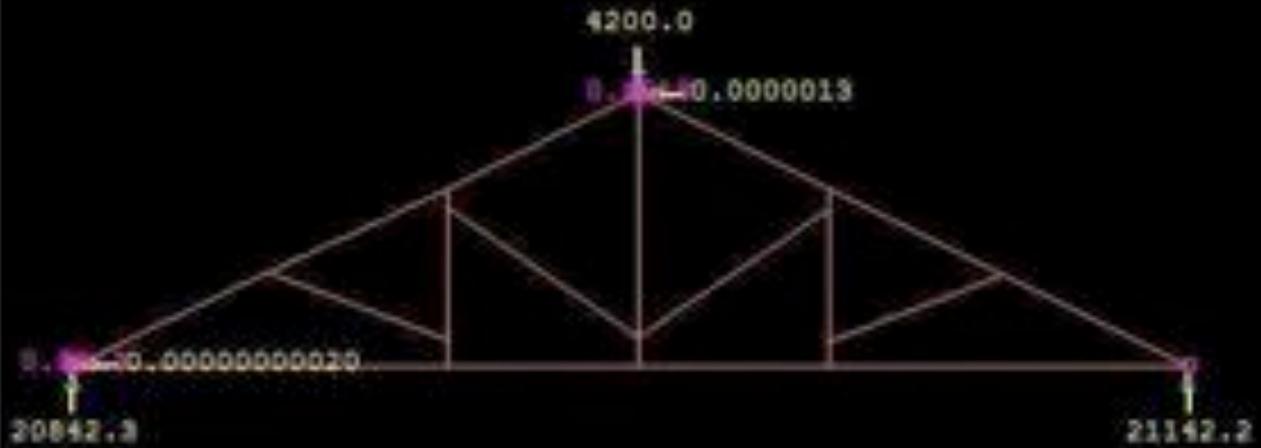
FINDINGS BY COMPUTATION

Truss Deflection Measurements



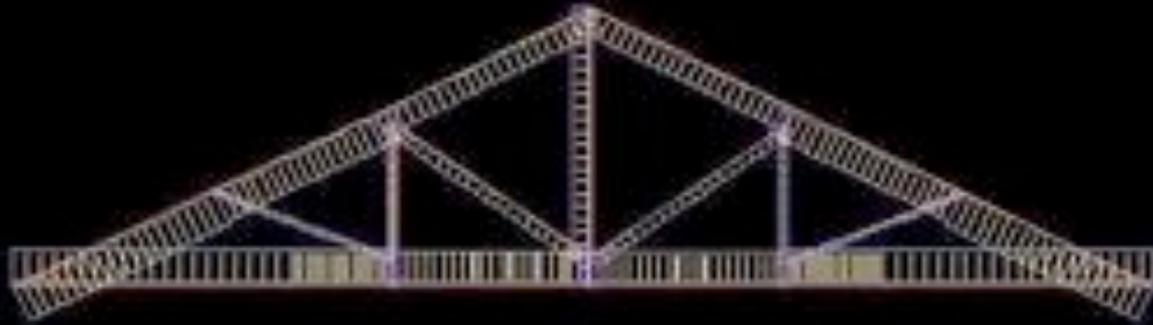
Note: Measurements for deflection recorded October 3, 2005 using laser measure and laser level. Benchmark at 27 5/16" above bottom chord of truss (top of iron strap on west face of truss 2).

REACTIONS LOAD 19



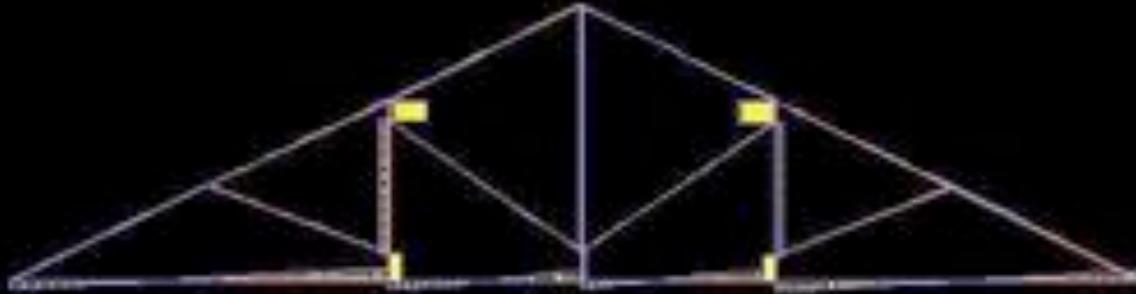
FINDINGS BY COMPUTATION

FX ENVELOPE



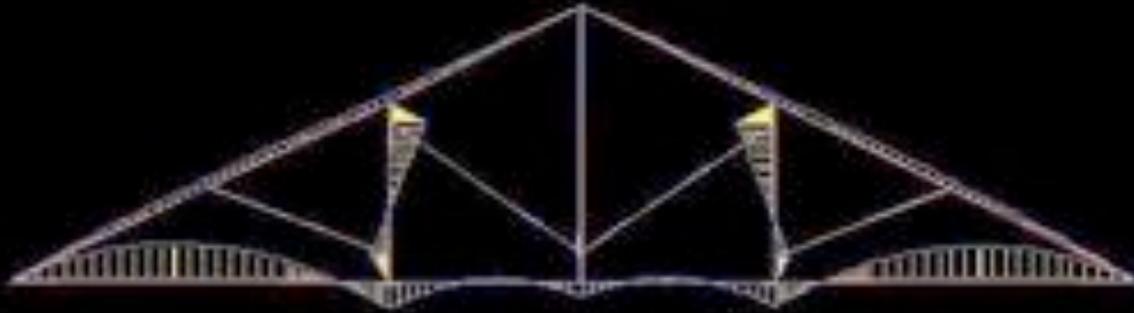
FINDINGS BY COMPUTATION

TY ENVELOPE

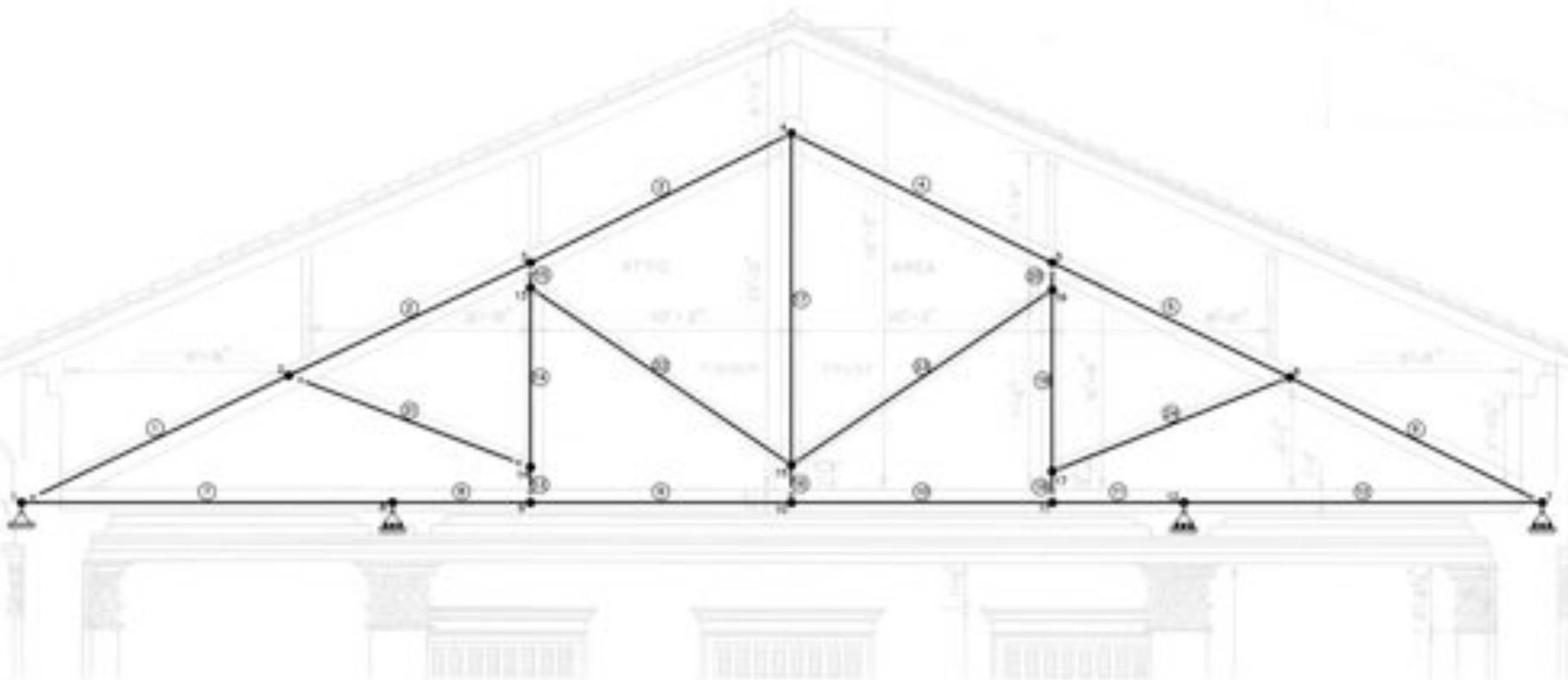


FINDINGS BY COMPUTATION

M2 ENVELOPE



FINDINGS BY COMPUTATION



- The stresses in the undamaged members are within allowable values, with some exceptions.
- Many of the connections between the truss members are severely overloaded.

Conclusions

1. The computed deflections of the trusses correlate with the observed behavior of the trusses.
2. Many truss connections are overloaded. Some of the original connections and some of the previous repairs are inadequate to carry the current loads.
3. Some of the truss members are overstressed.
4. Deterioration caused by termites and water infiltration, especially at the truss ends, has compromised the trusses.
5. There is some risk of plaster falling.

Recommendations

What are we going to do?

How are we going to do it?

Recommendations

1. Install crack monitors on current cracks in the sanctuary ceiling.
2. Examine additional areas of termite damage to determine the extent of damage in other truss members
3. Strengthen the truss connections to adequately support the current loads and stresses.
4. Strengthen and repair truss members to adequately support the current loads and stresses.
5. Install plaster washers in the plaster ceiling of the sanctuary to better secure the ceiling to the trusses.

Fundamental Objective:

Life Safety

Part II:

Project Overview for the First Baptist Church

Shoring Up to Floor



PROJECT OVERVIEW

Possible Removal of Pews and Site Protection



PROJECT OVERVIEW

Scaffolding and Site Protection



PROJECT OVERVIEW

Scaffolding and Shoring of the Trusses



Truss Repair and Strengthening



PROJECT OVERVIEW

Interior Repairs and Repairs to Areas Damaged During Construction



PROJECT OVERVIEW

Additional Work : Lighting, Fire Suppression, Acoustical, New Organ Installation



PROJECT OVERVIEW

Scaffolding Removal, Pew Reinstallation, Final Cleaning



PROJECT OVERVIEW

Project Phases

**Phase I: Investigation and Analysis
(80% completed)**

Phase II: Final Written Report (80% completed)

Phase III: Contract Documents – Plans and Specifications

Phase IV: Construction - Bidding, Contract Negotiation, Construction & Contract Administration, and Project Close-out

Project costs:

- **Design costs**
- **Fundraising costs**
- **Management costs**
- **Relocation costs**
- **Finance costs**

- **Construction costs**
 - Site Protection
 - Interior scaffolding and shoring
 - Truss repairs
 - Additional work on other systems
 - Plaster reinforcement and repair
 - Painting
 - Final clean-up

Total project cost:

It depends on what's done, but we expect that if only the truss work is done, the project will not likely cost less than \$1 million and not likely cost more than \$2 million. Please note that this is not a hard construction cost, but is a “gut feel” at this stage, based on our knowledge of similar projects with similar scope.

Project time:

- **Design**
- **Fundraising**
- **Project bidding**
- **Contract negotiation**

- **Construction**
 - Site Protection
 - Interior scaffolding and shoring
 - Truss repairs
 - Additional work on other systems
 - Plaster reinforcement and repair
 - Painting
 - Final clean-up

Total project time:

Once again, it depends on what's done, but we expect that if only the truss work is done, the project will take a total of about 24 to 40 months. Again, the same caution applies... this is not a hard schedule, but is a “gut feel” at this stage, based on our knowledge of similar projects with similar scope.

How do you begin? Like eating an elephant... one bite at a time:

- 4SE will finish the investigation and report and with your permission will proceed with the design work.**
- The church starts focusing on fundraising.**
- The bidding will come in about 8 months.**
- Finalizing a contract will take about 2 months.**
- Construction could start in about 10 months, with this kind of schedule, depending on the speed with which the church wants to proceed:**
 - Site Protection - 1 month
 - Interior scaffolding – 2 months
 - Truss repairs – 6 to 8 months
 - Additional work on other systems - 0 to 8 months
 - Plaster reinforcement and repair – 3 months
 - Painting – 3 months
 - Final clean-up – 1 month

- **By this schedule, construction would end in 26 to 36 months**
- **We'll be there to guide you through the process the whole way**



Oris 2



- 1849 Trinity Cathedral, Columbia, SC
 - Major damage to the trusses due to water intrusion

Trinity Episcopal Cathedral Columbia, South Carolina

Structural Assessment and Recommendations for the Interior Trusses

Presentation Prepared for:

Trinity Episcopal Cathedral Vestry Meeting

Thursday, February 28, 2008

Prepared by:

Craig M. Bennett, Jr., PE, and Lyles McBratney, 4SE, Inc.

Wilson Farrell

History and Historical Significance



Date of Construction: 1846
Architect: Edward Brickell White



Other Important Churches Designed by Edward Brickell White



Grace Episcopal Church, 1848
Charleston, SC



St. Philip's Episcopal Church Steeple, 1849
Charleston, SC



French Huguenot Church, 1846
Charleston, SC



- Plaster deterioration due to water infiltration
- Separation of trusses from walls



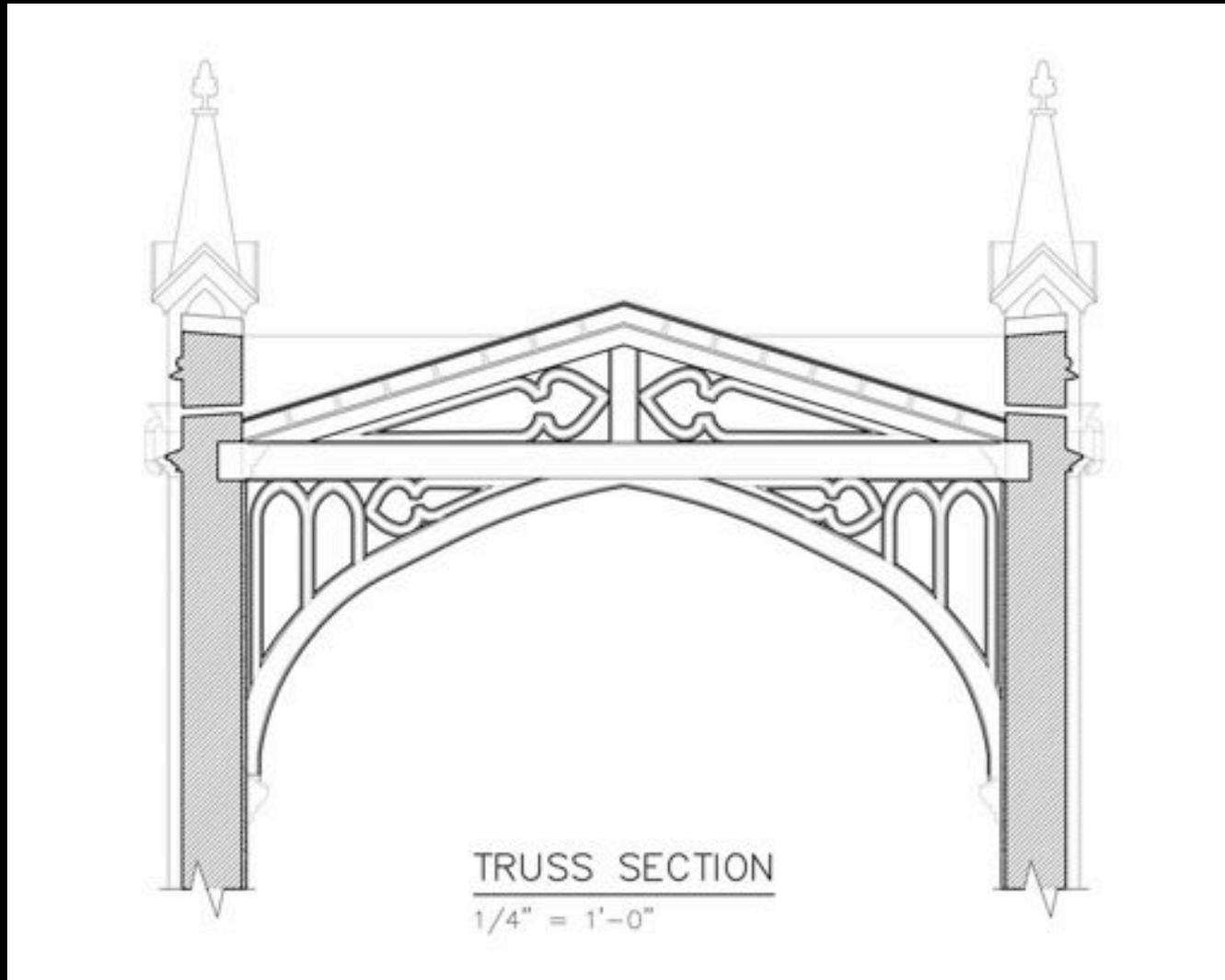
- Plaster deterioration due to water infiltration
- Separation of trusses from walls



Truss Members of Transept Crossing



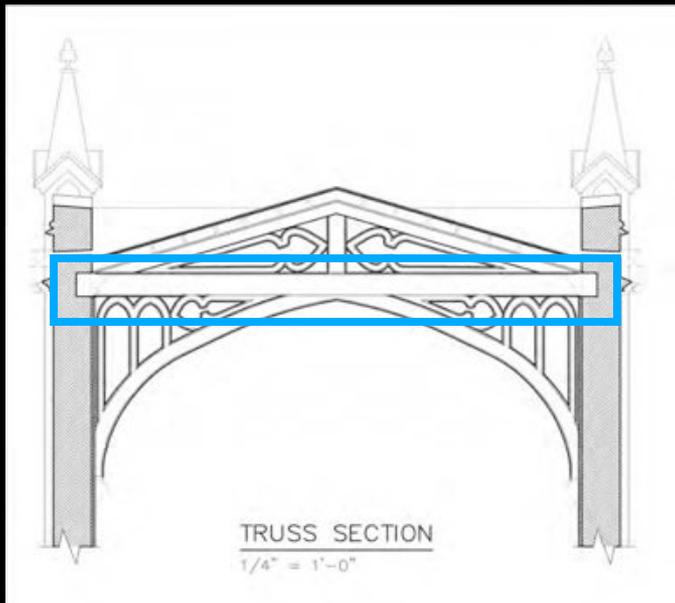
Truss Members of Nave



Truss Section of Nave

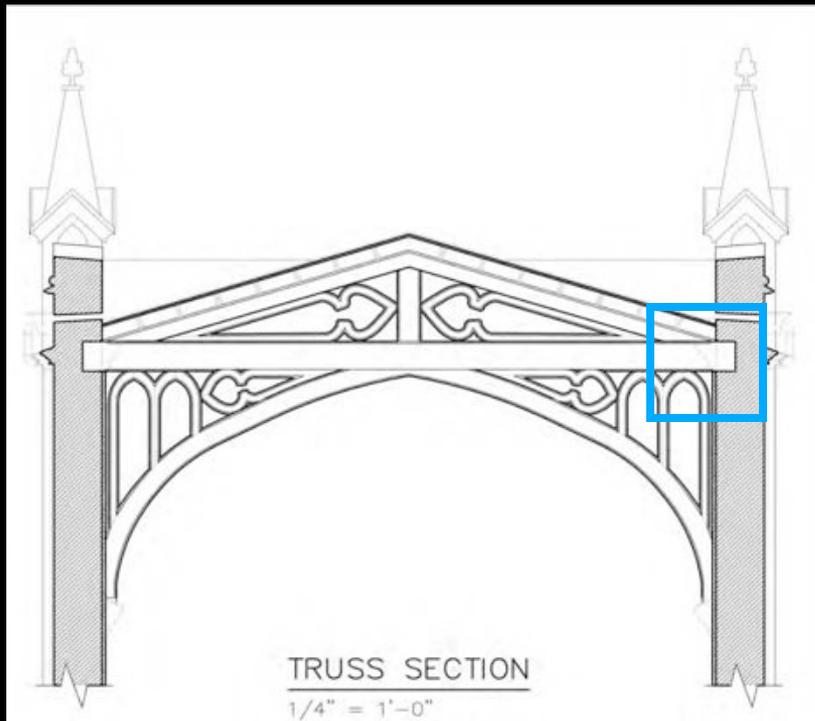


Each truss member is constructed of multiple pieces of wood.



The tie beam is constructed of a center core with four facing boards.





Intersection of tie beam
with masonry wall



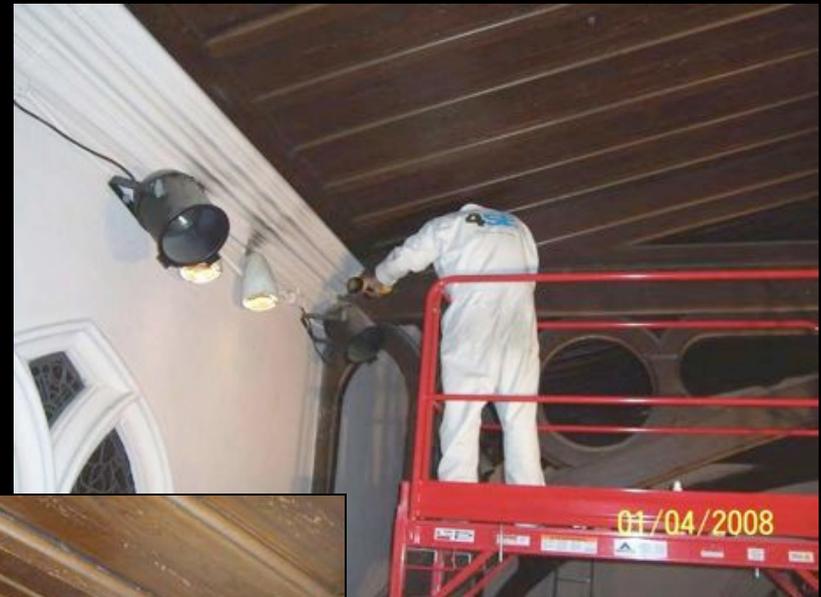


Surface Finishes

On-Site Investigation



Investigation of Damage and Deterioration of Trusses



2 short videos

Ron Anthony, Wood Scientist

Infrared and Resistance Drilling



General Summary of Findings

Termite Damage

Truss separation from walls

Roof line deformation

Sagging of front rail of balcony

Severe wood deterioration of trusses at masonry pockets

Damage to masonry pockets

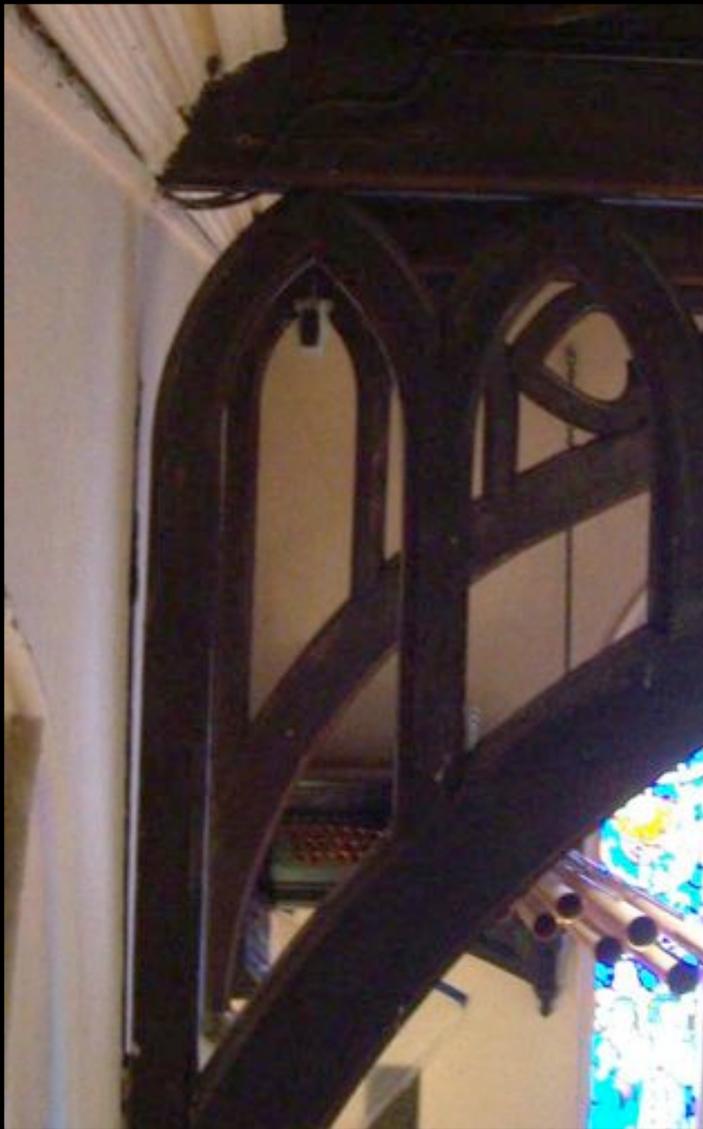
Trusses have dropped significantly

Crushing and splitting of truss members

Termite Damage



Truss separation from walls



Roof line deformation



Sagging of front rail of balcony



Severe wood deterioration of trusses at masonry pockets



Damage to masonry pockets



Trusses have dropped significantly



01/04/2008

Trusses have dropped significantly



Crushing and splitting of truss members



Crushing and splitting of truss members



Crushing and splitting of truss members



Crushing and splitting of truss members



Crushing and splitting of truss members





There is significant movement and deterioration of the truss system, including significant load transfer to areas which were not intended to carry any load. This is due to the deterioration and movement of the truss members, not the separation or settling of the masonry walls.

What are we going to do?

How are we going to do it?

Objectives

Method of Intervention

Project Overview

Fundamental Objective:

Life Safety

Interior structural repairs to truss members, including complete replacement, partial replacement, extensive repairs, and selective repairs



It should be noted that due to varying degrees of deterioration, no two trusses will require the same type or extent of repair.

Shoring Up to Floor

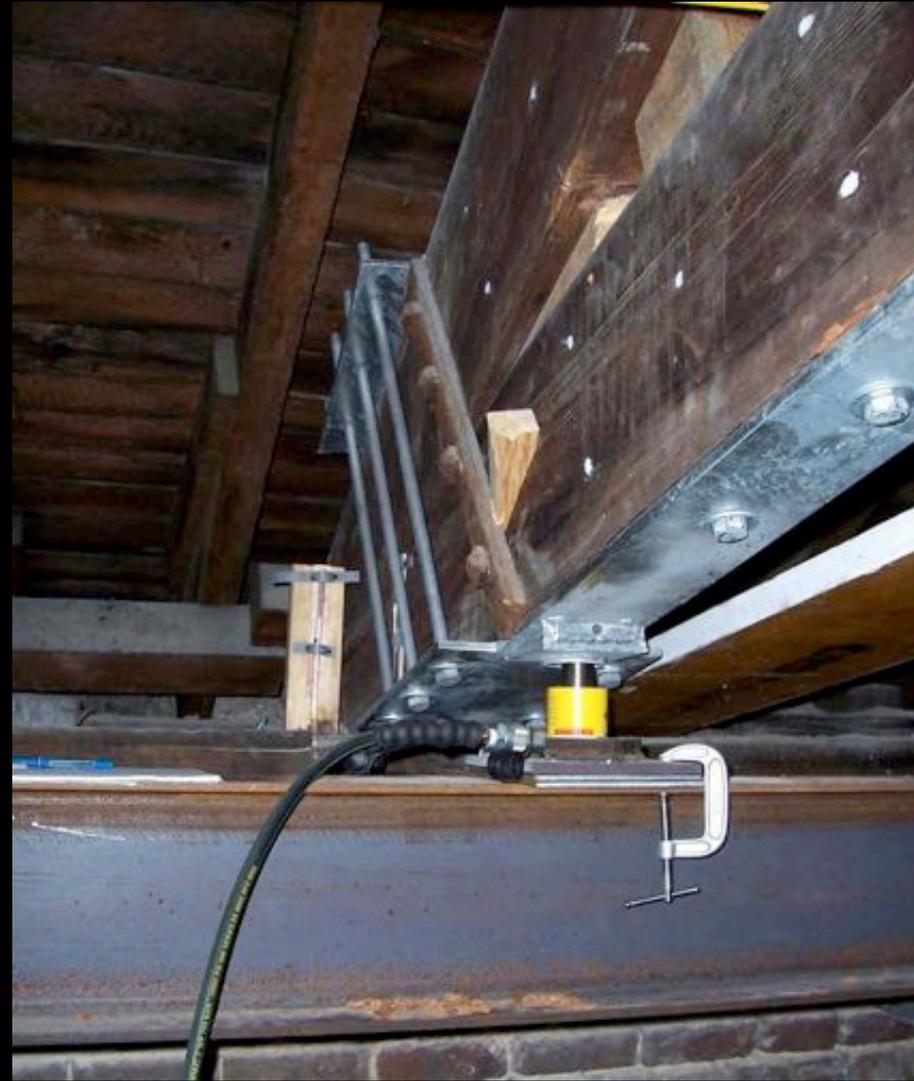


Removal of Pews and Site Protection



Scaffolding and Shoring Individual Trusses

Project Overview



Truss Repair and/or Replacement

Project Overview



Additional Repairs to Plaster, Masonry, and Molding and Treatment of Surface Finishes

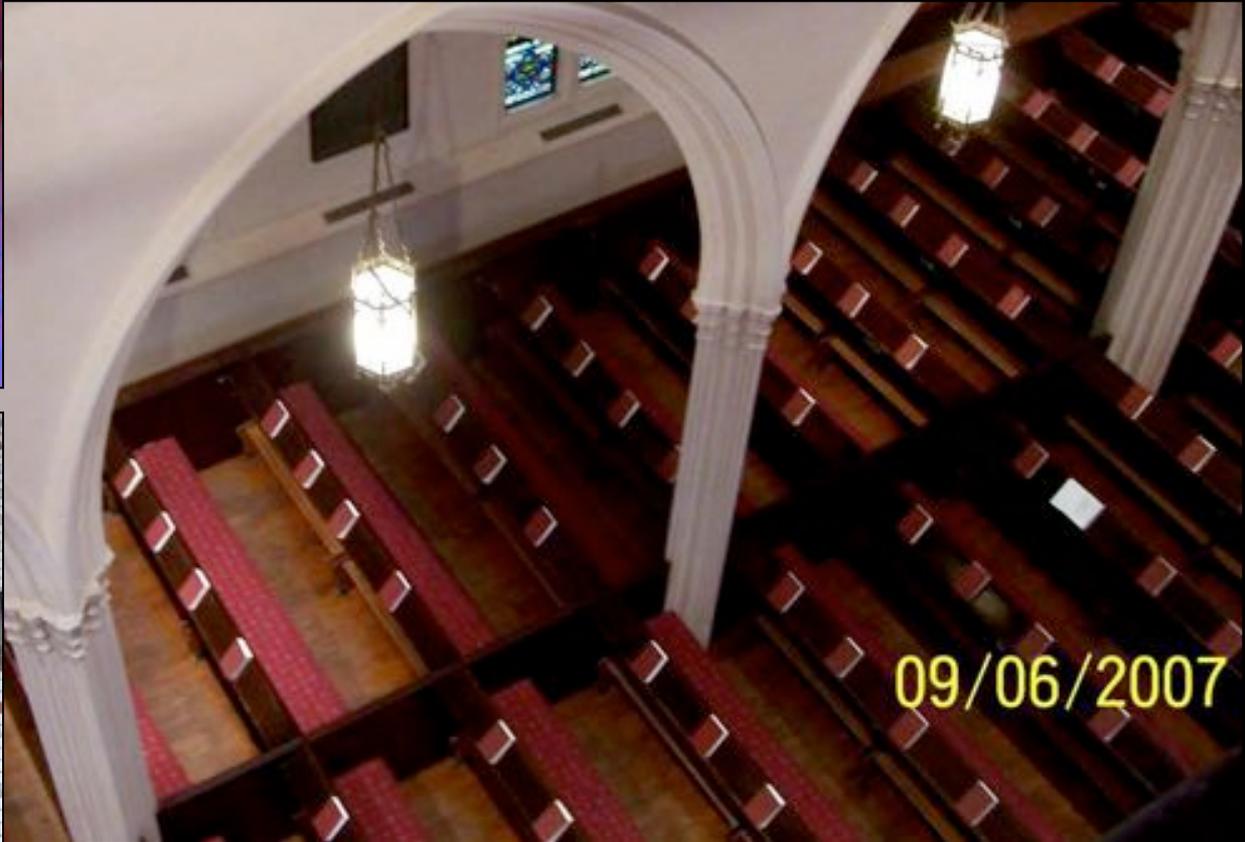
Project Overview

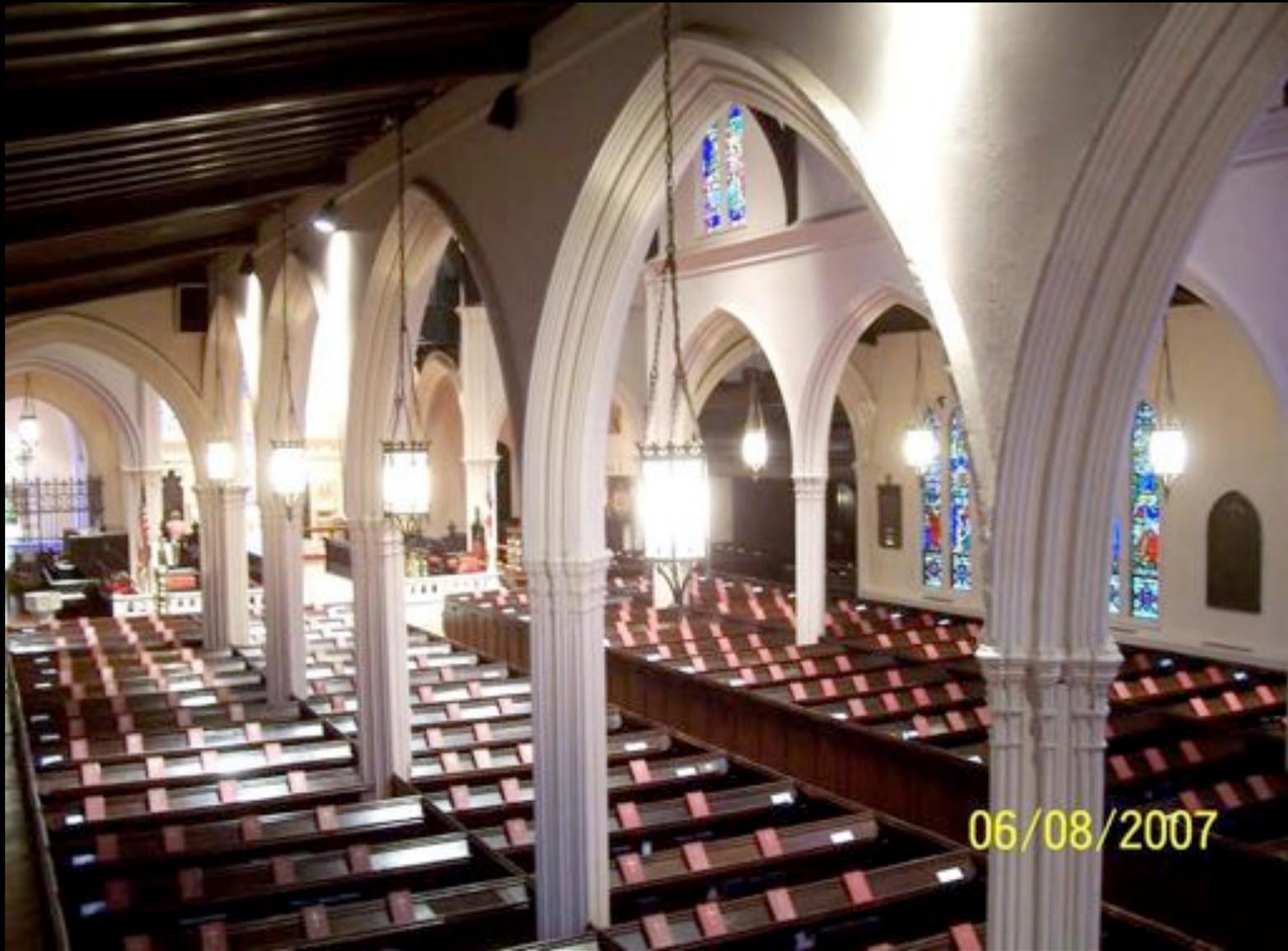


Additional Work : Lighting, Fire Protection, Acoustical











Interior Repairs

Scaffolding and shoring to be erected June 16th

Construction phase – 15-18 months

Cost:

Interior scaffolding and shoring: \$350,000

Truss repairs: \$850,000

Total estimate: \$1,200,000

This estimate only represents the cost of the truss repair. It does not include alternate work such as lighting, acoustical, painting, plaster repairs, removal, repair, and reinstallation of pews, and floor refinishing. They are included as separate items in the budget.

Summary

- Fundamental cause of damage in these structures:
 - Fort Washington, MD - Water intrusion
 - First Baptist Church, Savannah, GA - Increased load; Water intrusion leading to insect infestation
 - Trinity Cathedral, Columbia, SC - Water intrusion
- There is no single cause of damage to historic structures that can compare with water intrusion

Summary

- If you want a historic structure to last, other than not catching it on fire, there is nothing you can do that is more important than keeping the water out of the building.

Thank you!

- Craig M. Bennett, Jr., PE

